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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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CARVED CASE FOR AMERICAN STRIKING CLOCK.

DESIGNED BY F. FAULDING.

THE ordinary case of a large American striking clock is by no means "a thing of beauty," as a glance at Fig. 6 (see page 387), in which a clock of this kind is shown, drawn on a scale of 1½ in. to 1 foot, will serve to show. Still, such a clock is a good timekeeper, and the sound of the hours, struck in succession on a wire gong in the form of a coil, is so soft and full and deep that it is worth while to withdraw the clock and its appurtenances in the shape of works, pendulum, pulleys, cords, weights, and dial-plate from the old case, and enshrine it in a carved case, for which a pretty and easily-worked design is afforded in Fig. 1. That there may be no mistake as to the kind of striking clock that is meant, it may be said that the wooden case, taking outside measurements, is 2 ft. 1½ in. high, its breadth, 15¼ in., the width of the casing in front, including the plain external frame and the intermediate moulding, is 3 in. Further, the width of the external frame and of the framing of the door is ⅞ in. From these, too, it is easy enough to reduce the other measurements, which it is unnecessary to give in detail. It will suffice to say that the object of the frame and moulding is to afford room for the weights, which work up and down behind them one on each side. The framing of the door, which is hinged to the intermediate moulding, as shown in Fig 6, is divided into two parts by a cross-bar, and there is a piece of clear glass in the upper part, through which the dial is seen, and a piece of painted glass in the lower part, consisting, in the clock from which the sketch shown in Fig. 6 has been made, of a small bunch of flowers—a tulip, a rose, some nondescript bloom, and two or three leaves, on a red ground. The case itself may be spoken of as being plain even to ugliness, and the art work on the door as meagre and unattractive in the extreme. Notwithstanding this, the clock itself, which has been doing good service for more than twenty years, is much liked, and its appearance is condoned for by its utility, the familiar sound of its gong, and "auld lang syne" combined. Perhaps many readers of WORK are possessed of such a clock, and may wish to transfer the works to a new and better-looking case; if so, a design for the new case is now placed at their disposal.

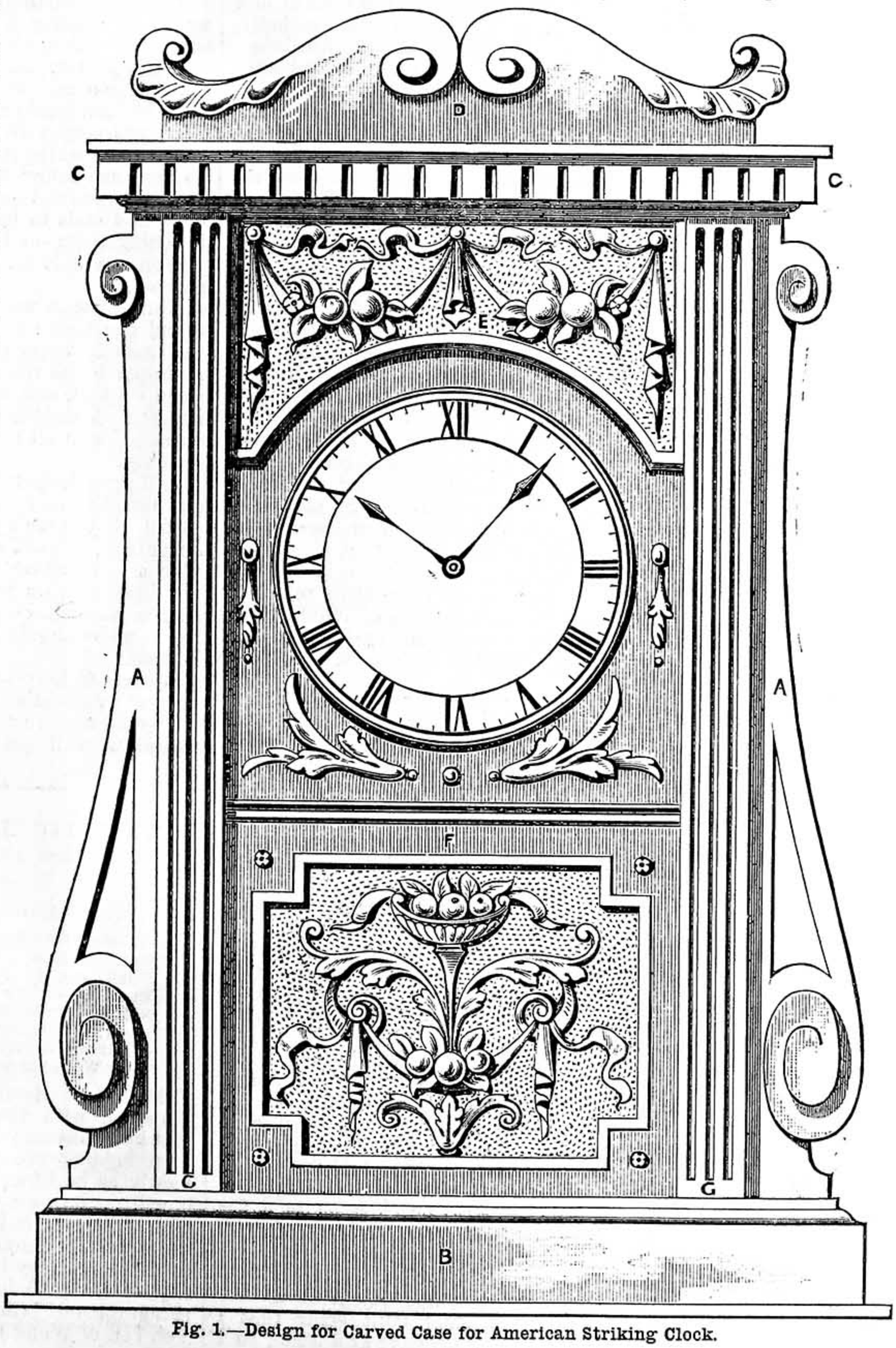
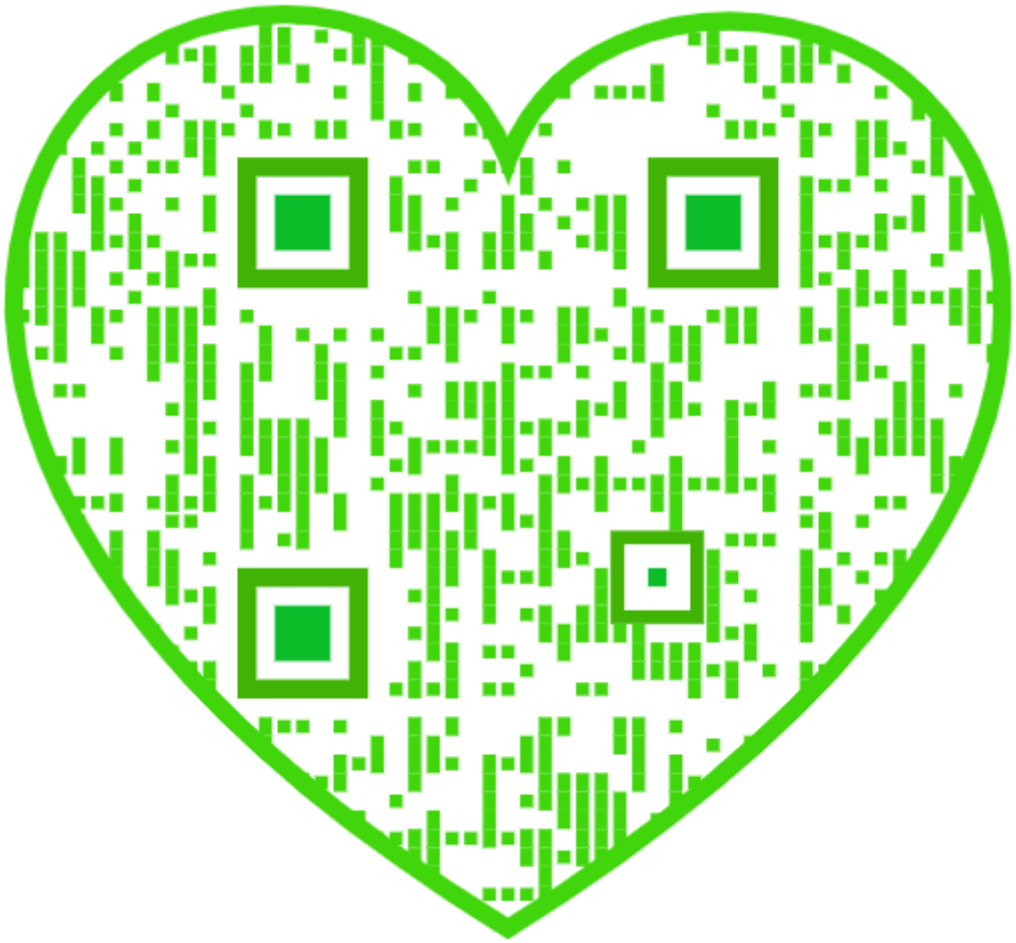


Fig. 1.—Design for Carved Case for American Striking Clock.

It must be understood, however, that the use of the design need in no way be confined to the large American striking clocks, of which one has been described in the above remarks. It may be modified by reduction to suit smaller clocks, and be made available for the small drum clocks which have to a great extent superseded the clocks with pendulums, etc.

With reference to the carved case represented in Fig. 1, it may be made in walnut or any similar hard wood. The size of the case must be determined by the size of the clock, and the first thing to be done will be either to make a new case, which will involve but little trouble and labour, or to get one made by a joiner or cabinet-maker, to whom the necessary instructions would have to be given respecting size. The case thus made would afford a basis or substructure on



which to fix the ornamental carving. The wood of which the case or cupboard is made should not be too thin—not less certainly than ½ in. stuff planed down; and possibly ⅝ in. stuff which would plane down to ½ in., or thereabouts, would be better. The brackets, A, A, shown at the sides in Fig. 1, should be dowelled or pinned to the sides of the casing, and the plinth, B, which must cover the entire bottom of the case, be screwed on from underneath. The cornice, C C, at the top should be treated in precisely the same way, and the pediment, D, blocked and glued to top side of cornice. The carving above the dial, shown on a larger scale in Fig. 2, will be best cut in a solid arch-shaped piece of wood ¼ in. thick, and then fixed on the upper part of the door, as shown in Fig. 1 at E. The carving below the dial, shown on a larger scale in the same manner in Fig. 3, should be attached to the door in the position indicated at F. Fig. 4 shows a section of the grooved or fluted pilasters, and Fig. 5 a section of the cornice. The pilasters, which are shown at G, G, are attached to the front edge of the case, and to a strip of wood fastened to the inside of the case, to afford a firm bearing for the pilasters. They form, with the cornice and the plinth, a framework for the door, which is hinged to the pilaster on the right-hand side. It is behind these pilasters that the weights will work up and down, as behind the broad moulding in Fig. 6. When the carving is completed it may have a finish imparted to it with wax or French polish, but the carved work should be left dull, and the mouldings only brightened in the manner described, as by so doing a superior appearance will be imparted to the whole of the work. Do not use any glass-paper in finishing the carving. Amateurs will sometimes do this, with the idea that their work will be improved thereby; nothing, however, tends to destroy the sharp and vigorous appearance of wood carving more than the employment of glass-paper in finishing.

Figs. 2 to 6 inclusive have been placed in the opposite page, as this arrangement is more convenient for readers.

I have omitted to mention that the dotted grounds shown in the carved parts at E and F are finished so as to present the roughened appearance indicated by means of any of the small punches that are used for this purpose. The end used for surfacing is generally fashioned into some form such as a trefoil, etc.

So much for the more ornamental and elaborate portions of the carved work of the clock-case—I mean those shown at E and F in Fig. 1—of which, after all, there is not so very much that involves what I may call carving proper, for the ornamental work in the pediment D, and at the head and foot of each of the brackets, A, A, is such as may be done by any woodworker of ordinary capacity; while the cornice, C C, and the fluted pilasters, C, C, present no difficulty whatever, or, at all events, ought not to do so, for the work in both of them is plain and straightforward, and in the latter case may be readily done by means of a scratch or router, which has frequently been mentioned and its construction described in Vol. I., page 101, of WORK. Thus even to a workman of no great skill the only portions that should present any decided difficulty are the parts at E and F, and possibly the small carved pieces on each side of the dial and just below it.

Now the question is, how may this difficulty be surmounted by anyone who cannot, or will not, attempt the carving. By fret-workers it may be easily done, for a thin overlay of the forms indicated at E and F might be placed in the positions now occupied by the carved work, and pierced, or cut with a fine fret-saw in such a manner as to imitate very closely the patterns that are given in Figs. 2 and 3. In this case the edge of the overlay will represent the outer lines of the projecting parts that form the borders of the panels, the borders themselves being omitted. The pattern being cut out will appear as if sunk in the overlay, and the wood below will appear through it. Thus, an effect similar in some measure to inlaid work will be produced, and, if the door of the clock-case were ebonised, and the overlay were of thin white holly, or, better still, of xylonite, the semblance of inlaid work in ebony and ivory would be obtained. Another and perhaps a better way would be to cut out the carved work in outline in the flat, and the borders of the panels and other ornamental parts, at the sides of and below the dial, in xylonite or white holly, and attach them with glue to the woodwork below. Indeed, a very close resemblance to the actual carved work itself might be produced, if, instead of cutting or carving it out from the solid, the framing of the sunken parts and the carved pattern were cut out in wood of ⅛ in. in thickness by the fret-saw, and the edges sufficiently reduced and rounded, and the markings of the foliage and drapery sufficiently taken out by aid of a V-tool to remove all impression of the flatness that is inevitable if the cut-out pattern were put on in the solid; or, in other words, of uniform thickness throughout without any attempt at relief by the means of the V-tool and the simple tools used in chip-carving. It will be understood that when xylonite or any other material is used to gain the effect of inlaid work, the material should be as thin as possible, not thicker, in fact, than cardboard or Bristol board of tolerable substance. So much has already appeared in WORK upon the subjects of inlaying and marquetry that these matters need not be gone over again here. Nor is it necessary to do more than refer the reader to the "Shop" pages of WORK for all information as to materials, etc., for carrying out the present bit of woodwork.

AN EASILY MADE FIXING TANK.

BY W. E. D., JUNR.

HYPO. BATH—ITS NECESSITY—BEST FORM—MAKING TANK—MATERIAL TO USE—SIZE—HOW MADE—CASE FOR TANK—DIPPER—COVER.

EVERYONE who has taken up photography knows that before the negative can be brought into the daylight and used, it must be placed in a hypo.-sulphite of soda solution; this solution must (or ought, if good work is to be done) be kept in a separate dish or tank; the question then arises, "What is the best form to use?"

In my opinion it is one in which the negative is placed in an upright position, as in the old wet-plate process the glass was let down into the silver bath, because in this position the silver, as it is fixed out, settles to the bottom of the tank, as well as other impurities, and this is not disturbed when other negatives follow, as in a flat dish; it is also easier to take out, and much less fear of breaking the film.

For a long time I used an old silver bath to hold the hypo., and found it answer fairly well, the chief fault being that I could only fix one negative at a time; so I resolved to make a larger one, and looking round for a material to use, I fixed upon gutta-percha, and have found it answer exceedingly well.

Suppose the reader wishes to make one to take half-plates as the largest size. I would recommend that the bath be just about the size for half-plates one way and quarter-plates the other—say, an inside measurement of 6⅝ in. × 3⅜ in. × 6 in. deep; it is as well to decide upon the exact size. Cut out paper patterns and take these to the shop, so that the gutta-percha can be cut from the piece to the proper size and shape, thus preventing any waste.

When you have the five pieces ready for making the tank, heat an iron red-hot, draw along the edge of one piece and the side of another, bring the two pieces quickly together, and by holding a little time until set they will be firmly fixed; if not, and they betray any tendency to spring apart, you may use small brads or screws, as you would in making a box. Proceed in the same way with the other side and end, then put the bottom on; when done, take the red-hot iron and draw along the edges of the join both inside and out: this will cause the gutta-percha to run and fill up any holes, thus making it perfectly water-tight; do the same round the heads of the screws or nails; you can then put grooves along the sides and ends to hold the different plates, fastening them on in the same way; then put on one side for a little time so that it may set.

Now make a wooden box to fit tightly round the tank: thin wood, such as ¼ in., will answer every purpose, but unless the gutta-percha is thick it will be better for some support, and by using thin it comes cheaper. Make the bottom of the wood box an inch larger all round: this gives greater stability.

A dipper, to put the plates in the tank and take them out again, will be found very useful. If you have one belonging to an old silver bath, this will answer perfectly; if not, take a strip about 7 in. × 2 in., either of gutta-percha, thin wood well covered with shellac varnish, or glass; a ledge to hold the negative should be cemented on at the bottom.

A cover to keep out the dust and partly prevent evaporation completes the tank.

Should any further information be required it will gladly be given through "Shop."

ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

MORE ABOUT CHALK WORK.

CHALK AND PEN ON STONE—CORRECTIONS AFTER ETCHING—HOW TO HOLD CHALK—MODE OF WORK ALWAYS PERCEPTIBLE IN COLOURED DRAWING—GROUP OF LEAVES—MIXED STYLE IN COLOURED WORK—INTELLIGENCE AND FEELING IN WORK—LETTERPRESS, WITH DRAWINGS—UNIFORMITY DESIRABLE IN SERIES OF DRAWINGS—WORKING WITH MAGNIFYING-GLASS.

THE student should feel that he grasps the stone with the chalk—that is to say, that he works into the grain of the stone.

In holding the pen, he may use it as lightly as he likes, as the ink flowing from it will do its own work on the stone; but with the chalk it is different, for he must use a certain amount of pressure, however light the tint may be: therefore the necessity of using light crayon-holders. (*Vide* paragraph on "Chalk," page 66, No. 109, Vol. III. of WORK.)

There are times when corrections can be made after the stone has been etched by darkening tints with the chalk, but the artist should advise the printer that he intends doing so, that the stone may be most carefully prepared for him. He must remember in making alterations by stippling over chalk work not to do so too strongly, or to make the dots too large, as the tint already on the stone is most deceiving to the eye, and an otherwise good tint may be completely spoilt by the dots showing up when printed about three times the strength of the rest of the tint.

There are as many modes of working with the chalk as there are with the pen; in fact, more, as there is so much more scope for the student's artistic taste to have its bent. In drawing a sky, a flat point would be preferable to a fine round one, and by holding the chalk at the end of the holder make the lines as broad as possible; or don't show any lines at all, but put a tint on the stone with the broad chalk evenly and smoothly; in fact, almost rub it on, making it stronger at the top and gradually fade into the distance. Should there be clouds in the picture, these may be drawn in comparatively short, broad, *curved* lines fading at either end, which may be joined by and slightly crossed by others at a slightly different angle. When this is filled in a good effect is produced by the different treatment in working; but I really can only repeat myself, and say, in lithography, the same as in drawing or painting, the student must use his own artistic knowledge and taste, and know what style of work is necessary in drawing different objects; and if he persistently follows the elementary and necessary rules, the knowledge and experience will be gained by every succeeding piece of drawing he produces.

On looking at a coloured drawing which has been drawn with the brush and pen, the *mode* of work is invariably seen, whether the tint be broken, flat, or shaded, etc. For instance, anyone who understands lithography can immediately, on looking at a Christmas card, tell whether it has been worked in little lines or dots, etc. But in

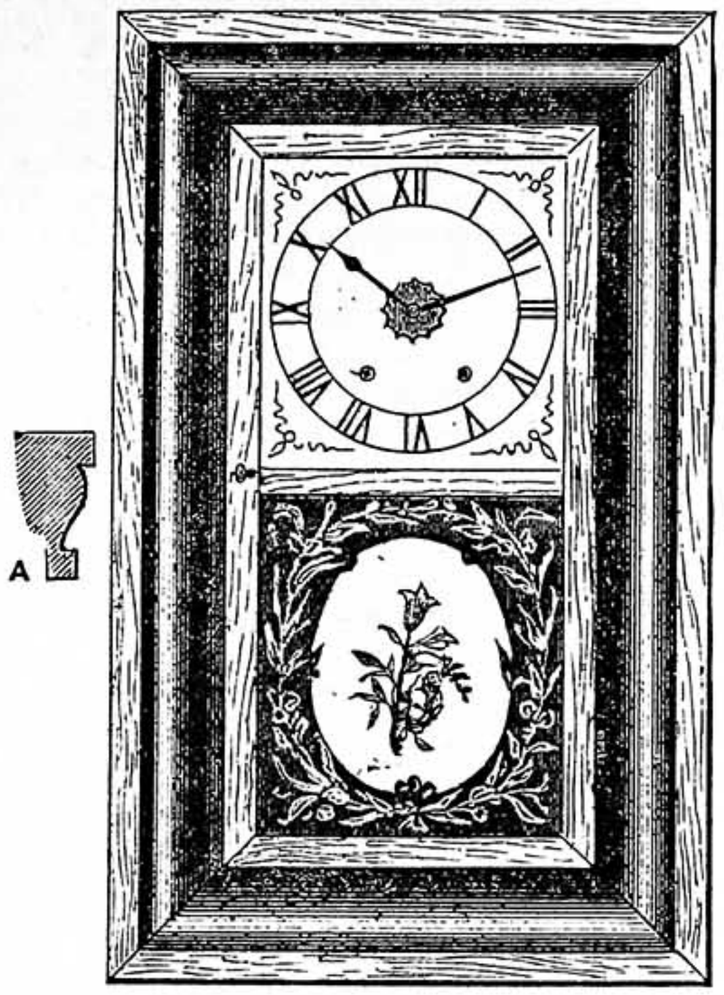


Fig. 6.—Ordinary Case of Large American Striking Clock—A, Section of Moulded Frame.

chalk drawings the style of work is not quite so easily detected, especially in colour printing. You can only see the effect, which certainly gives the drawing a much more natural and artistic appearance, although, from a commercial point of view, perhaps not so profitable, because of the necessity of printing from the original stones, on account of the difficulty in transferring good fine chalk tinting.

Take a group of leaves. In pen work they would be either stippled or drawn in fine lines, which must inevitably show when printed; but in chalk the tinting would be laid in in clear firm lines, with a broad point and the side of the chalk used; then, after crossing these at about an angle of 25° with lighter ones, still using the broad point, fill in any patches or spaces left with a fine pointed chalk. If this be printed in colour, a much more natural water-colour effect is produced. Of course, if a lot of colours are used, it considerably lightens the artist's work, besides the finer finish given to the drawing; but as everything nowadays has to give way to cheapness, we have to see how to obtain the best possible result with the fewest possible colours. By using a strong yellow, blue, or red, as the case may be, and shading it in such a manner that when the one colour is printed perhaps half a dozen different tones are produced, will naturally reduce the expense, instead of printing two or more shades of the one colour, which, in the above instance, is done away with by the artist's cleverness in execution.

Very often in coloured drawings the style of work may be mixed: that is, some of the colours worked with chalk, and others stipple, but it is simply an impossibility to say which means should be used for any special colour. I can only quote for example a good-sized landscape subject, with figures, etc., in the foreground. Now those stones on which the sky and distance are worked would be most effective done in chalk, whilst the figures, foreground, etc., would be best drawn in lines—stipple, splash, etc. But the student must not forget that should he be working a light blue stone, which would draw the sky, he must also draw the foreground in that colour in chalk, as the stone will be grained.

I trust I have not tired the student's patience in endeavouring to explain how to execute a good piece of artistic drawing. but I am sure he will understand how much I want to impress upon him the necessity of putting intelligence and feeling into his work, so that he may not fall into that fatal error of being a mere mechanical machine, which, unfortunately, is too often the result of any art requiring technical manipulation, and which in lithography consists in reproducing drawings and sketches by means of dots and lines.

After a drawing is completed, letterpress is sometimes required to be added at the foot of it; so to save an extra printing this is done by the draughtsman, and transferred to any one of the stones, whichever colour is most suitable: generally a dark grey or brown; but the artist must know where this is coming, and, if possible, not etch that part.

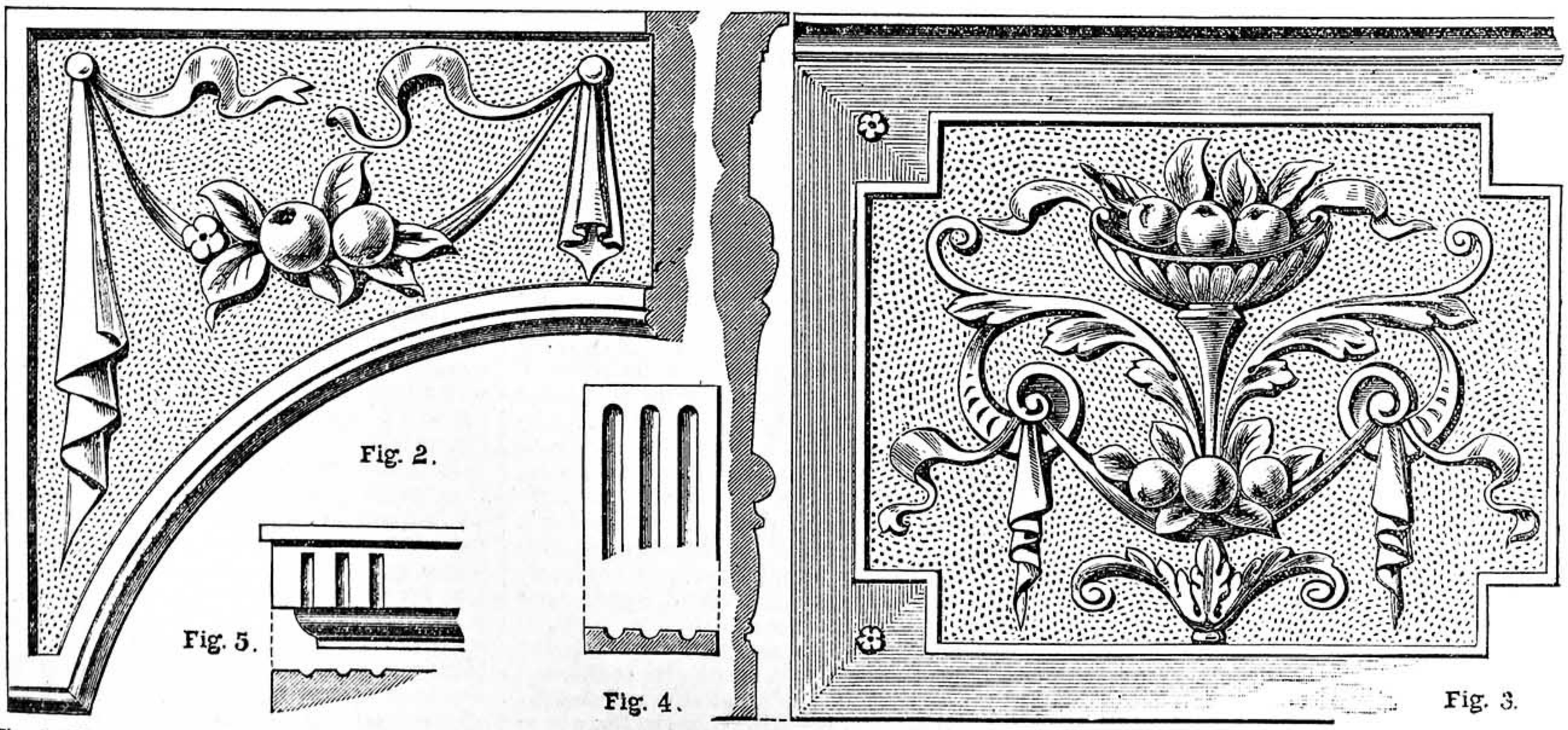


Fig. 2.—Half of Carved Arch at Top of Door as shown at E, Fig. 1. Fig. 3.—Carved Work on Panel at Bottom of Door, below Dial, as shown at F, Fig. 1. Fig. 4.—Top and Section of Pilaster at Side of Door. Fig. 5.—Section of Cornice above Door.

In arranging a series of small drawings on one stone, the student should try and get those of the same tone together, for he will see presently in practical work that it is not well to draw, say, half a stone with very heavy work, such as solids and strong tinting, and the other half with very fine line and stipple work. The drawings should, if possible, be uniform, or two different stones should be used. I do not mean those subjects requiring the gradations in shading from strong tinting or solid to the finer shades, such as the above diagrams; but where *one* drawing may require great depth, strength, and force in working, *another* may require to be very delicately and finely drawn; and as the etching for two such dissimilar pieces of work requires different treatment, which will be spoken of later, it would not be advisable to have them on the same stone, more especially as in the printing the former would require double the quantity of ink to the latter.

I must warn the novice against the bad habit of accustoming himself to work with a magnifying-glass, for if he does this he will get so used to it that he will only with great difficulty and force of will be able to do a fine tint without it, especially in stipple work; and it is unnecessary, I am sure, for me to point out the strain it would be on the eyes to continually look through glass.

In some fine work it is absolutely impossible to do it clearly and distinctly without; but as this is an exception, there is no reason why it should be made a practice, and after any such work is finished the glass should be entirely put away, and not brought out again unless the occasion requires it.

BOILER EXPLOSIONS.

BY FRANCIS CAMPIN, C.E.

CLASSES OF BOILER EXPLOSION—BOILER INSURANCE—PHENOMENA ARISING FROM THE BOILING OF WATER—SUDDEN CONVERSION OF AIRLESS WATER INTO STEAM—FOWLER'S EXPERIMENT—EXPLANATION OF CAUSES LEADING TO BOILER EXPLOSIONS—DEFECTIVE PLATES.

THE failures of boilers by explosion or collapse may be divided into two classes: those in which the causes lie on the surface, and are, therefore, easily ascertained; and those in which the accident occurs under circumstances that do not admit of a clear explanation.

The former class of disasters may be prevented by care and intelligent supervision, such as is now rendered available to all steam boiler users by the Boiler Insurance Companies. They are due principally to two sets of causes: one is wear and deterioration by corrosion, and the other over-heating of flues, commonly arising from the deposit of scale.

To the unscientific observer the boiling and evaporation of water seems a very simple process, and one not at all likely to give rise to any surprises. This, however, is not the correct view, and it has long been known to physicists that under certain conditions the heating of water may lead to phenomena of an explosive character. It is well known that water has the property of absorbing and retaining considerable quantities of gases: hence water found in nature will be saturated with atmospheric air, and this air exerts a notable influence on the behaviour of water when heated, as it seems to aid its evaporation. Many years back M. Donny, of Ghent, found that water deprived of its dissolved air might be heated to a temperature of 360 degrees Fahr. before it entered into ebullition; it would then burst into steam with explosive violence, scattering the contents of the vessel containing it. For a reason which will subsequently appear, we call particular attention to the fact of the suddenly developed steam carrying the surrounding water with it. Of course, the whole mass of highly heated water is not vaporised, as a great quantity of the heat is immediately rendered latent by vaporisation of a part of it. The excess of heat over the boiling point is 148 degrees; and, as the latent heat of steam at atmospheric pressure is 967 degrees, only between one-sixth and one-seventh of the bulk of water could be evaporated at that pressure, though, of course, a smaller quantity might be generated at a higher pressure. The reason a smaller quantity of steam would be evolved at the higher pressure is because the water, keeping the same temperature as the steam, would not yield enough sensible heat to become latent. This explosive action has been pointed out as a possible cause of boiler accidents by some scientific authorities, especially in cases where fires have been banked up and the water unrenewed for some time; but on this point we shall have more to say.

A short time since Mr. F. G. Fowler, of Connecticut, U.S.A., made an experiment which tends to show that it is dangerous to use water containing air. According to this scientist, if water containing air is heated in a boiler until steam of low pressure—say, about 40 lbs. per square inch—fills it, and it is then inverted or shaken, the pressure will suddenly rise to about 80 lbs., and this, he thinks, indicates the cause of many boiler explosions. He accordingly advises us to discharge all the air from the water before feeding it to the boiler.

Taking these two statements as they stand, we appear to be in a dilemma, for whichever way we turn we are met by danger. One experiment shows that airless water is most dangerous to use, while another leads to the conclusion that the presence of air may lead to a catastrophe. Let us, however, look a little closer into these matters, and see if we cannot find some means of escape. We will go back to the case of the water from which the air has been discharged.

In the first place, it is to be noticed that the experiment is made under atmospheric pressure, 15 lbs. per square inch, so that when a part of the heated water bursts into steam there is no sufficient resistance to prevent it acting suddenly and carrying the remaining water with it; and, as water strikes a somewhat solid blow, a startling effect is produced. If, however, this water were in a boiler containing steam at 150 lbs. (absolute) pressure per square inch, the evaporation would proceed quietly, because there would be a resistance equal to the force of the fresh steam generated, or on the point of being generated; for while the temperature of the water and superincumbent steam are the same, evaporation will be suspended. Now, if we suppose the boiler pressure be allowed to run down to atmospheric pressure or thereabouts, and then rapid evaporation to commence, the steam thus evaporated, being confined, would rapidly rise in pressure and, of course, in temperature; and as soon as its temperature exceeded that of the water it would be condensed again, so that the pressure in the boiler could never reach 150 lbs.—that is, 135 lbs. above the atmosphere—so that actual bursting from over-pressure is hardly to be feared on this account.

There is, however, another view of the case. Water deprived of its air by mechanical means is in a different position from that deprived of air by heat in this respect, that when the air is removed in the former way the molecules of water come closer together, and, their mutual attraction becoming proportionately stronger, they require a higher degree of heat for their dispersion into vapour, and this dispersion will take place in a more vigorous manner. When, however, air is driven out of water by heat, it would seem reasonable to conclude that it is displaced by aqueous vapour, in which case no closer approximation of molecules will occur, and the water will evaporate at its normal temperature. If the case were otherwise, we might expect an explosion every time a boiler fire is lighted, as the air is driven off before the temperature of ebullition is reached. It is very obvious that water does dissolve or absorb steam in proportion to the pressure under which it is in contact with it; for if we draw water from a steam boiler into an open vessel a large quantity of steam will escape, and this steam is certainly not *generated* after the water leaves the boiler. If the water, after having been boiled, is allowed to cool so that air cannot reach it, it will, when cold, assume the condition of water from which air has been removed mechanically; but if air has access it will be absorbed, and the water will resume its normal condition.

Mr. Fowler's experiment of inverting or shaking up a boiler represents a state of affairs which can hardly occur except in a railway accident or a collision between steam vessels; but yet it has an interesting aspect, and further researches to determine the cause of the results reported would seem worth undertaking. A hypothesis might be hazarded that the air first expelled from the water carries up with it the vapour with which it is saturated at a temperature of 212 degrees, and remains in that condition in a stratum separate from the steam subsequently generated, and at a lower temperature. When agitation or inversion occurs, the air and its contained aqueous vapour will be raised to a temperature of 287 degrees, which will necessarily cause their expansion, and therefore the increase of pressure in the boiler. If this is the explanation, the trouble would cease as soon as the boiler gets to work, as the air entering with fresh feed water would all be heated up to the full temperature in passing through the water already in the boiler. If danger is anticipated, the first lot of air might be got rid of by blowing it off.

It has been suggested that boilers have been destroyed by sudden blows from the contained water due to its being carried up bodily by its contained steam on the occurrence of a sudden loss of pressure—such, for instance, as would happen if a plate gave way and released the steam instantaneously; but this is a case which is under control, as the primary cause is the defective plate. Taking the matter altogether, it seems that the causes of boiler explosions are getting to be pretty well understood by those whose speciality lies in that direction, and that before long what remains of mystery will be for ever cleared away.

Readers interested in this subject should read the papers on "Engine and Boiler Management," by Mr. M. Powis Bale, which are now appearing in WORK, and which afford much useful information not to be found in a collected form elsewhere.

DOVETAIL JOINTS.

BY FRED CROCKER.

TOOLS—COMMON DOVETAIL—SPACING—POSITION OF PINS—LAP DOVETAIL—SECRET DOVETAIL, LAPPED—SECRET DOVETAIL, MITRED—DOVETAIL HALVING—HALVING DOVETAILED BOTH WAYS—BLOCK APPARENTLY DOVETAILED ON FOUR SIDES.

DOVETAILED joints are used in a great variety of trades and materials, but the present paper will only apply to those used by the wood-worker. These consist of a taper mortise or socket on one piece (B, Fig. 1), and a pin or tenon on the other (A, Fig. 1).

Tools.—A detailed description of these will be scarcely required, as they are in general use for other purposes, but a small-backed saw, known as a dovetail saw, and a few bevel-edged chisels will almost be absolutely necessary.

Common Dovetail.—The most common form is used at the angle of two boards (Fig. 1). In making this joint, both edges are shot true and square; a gauge-line is run round one board at a distance from the end equal to the thickness of the other one, and the other board is treated similarly. Now, two methods are followed. Some mark and cut the pins first; others the sockets. In the first method (B, Fig. 1) you would have the pins carefully spaced, and the angles marked with the bevel; the saw would be run in down to the gauge-line, and the spaces between cleaned out with chisel and mallet. Then B would be put on the top of A, and the mortise marked with a sharp-pointed scriber. These would then be squared over, cut down to the gauge-line, cleaned out, and tried together. The second method is to first mark the sockets on A (sometimes on common work the marking is dispensed with, the workman using his eye as a guide); then run the saw in down to the gauge-line; put A on B, and mark the pins with the front tooth of the saw; cut the pins, keeping outside of the saw-mark sufficiently to allow of the pins fitting fairly tight; then both pieces may be cleaned out and tried together. In cleaning out the mortises and the spaces between the pins, the worker must first chop half-way through, then turn the board over, and finish from the other side, care being taken to hold the chisel upright, and not so as to cut under, as shown in Fig. 2, which is sometimes done to ensure the joint fitting on the

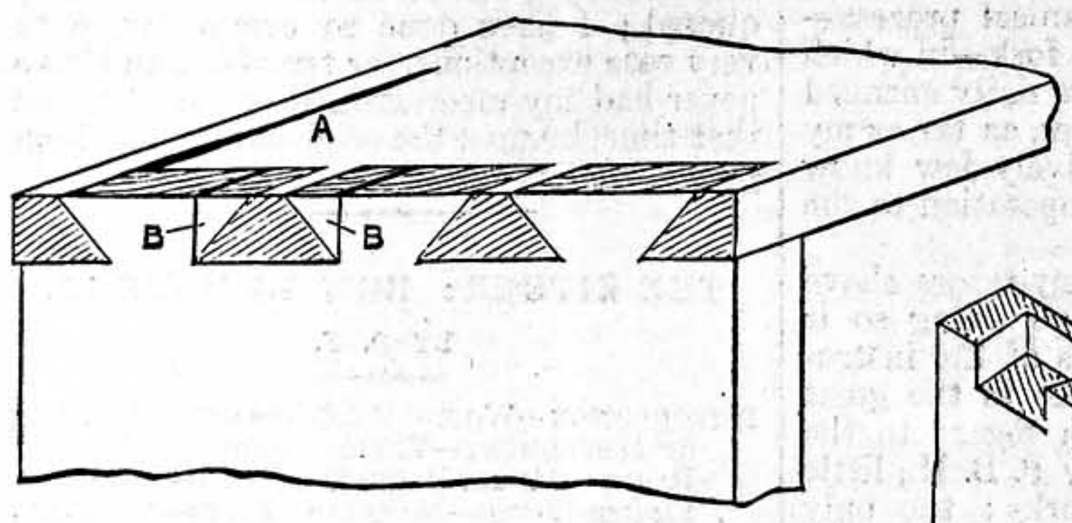


Fig. 6.—Secret Dovetail mitred.

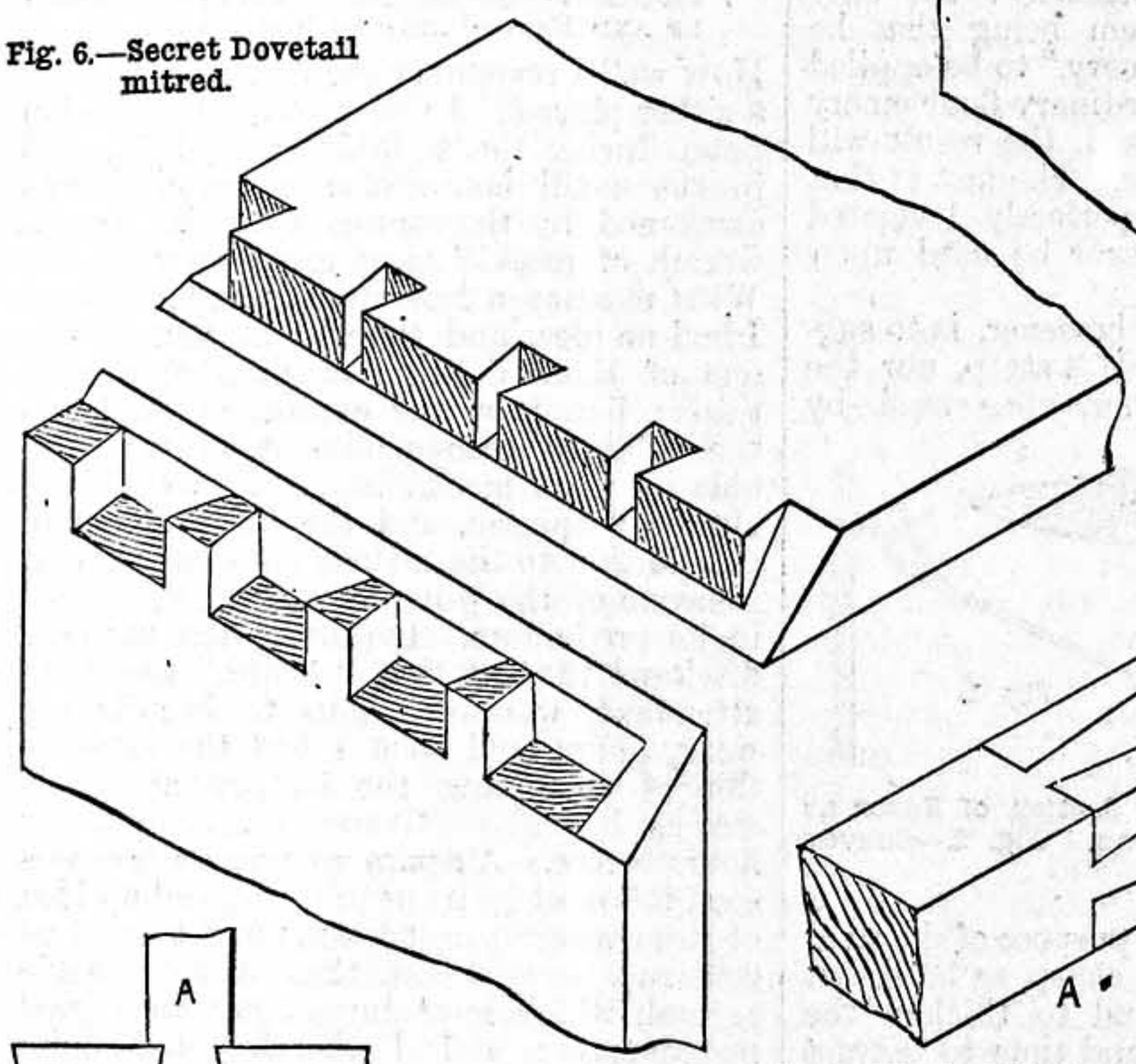


Fig. 3.—Dovetail bevelled too much.

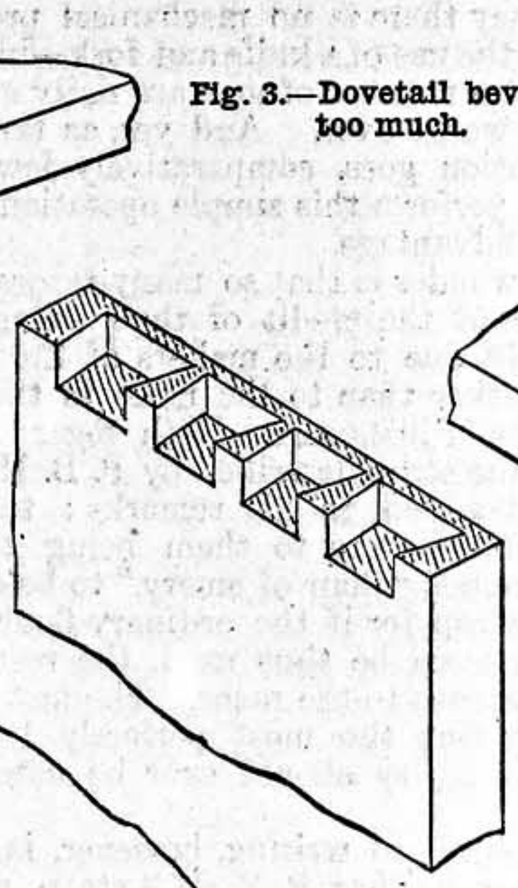


Fig. 4.—Lap Dovetail.

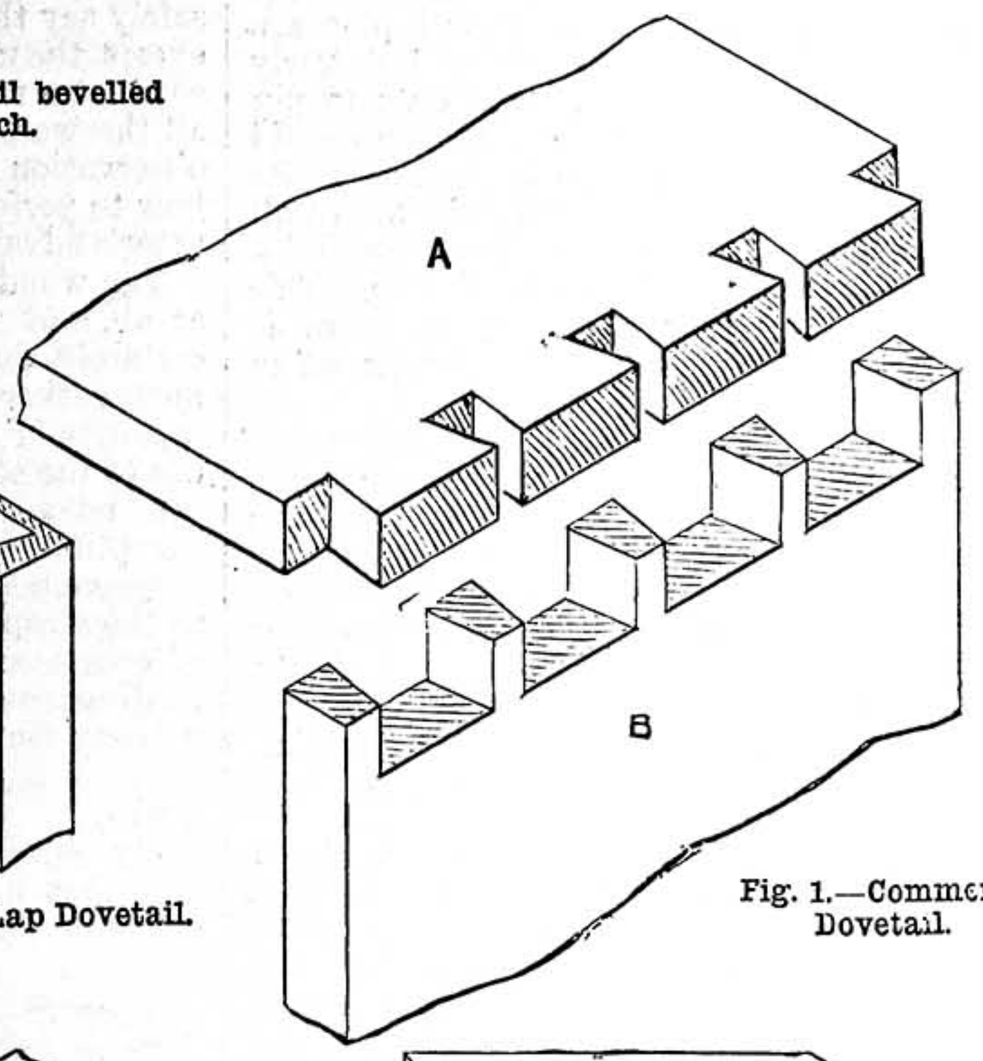


Fig. 1.—Common Dovetail.

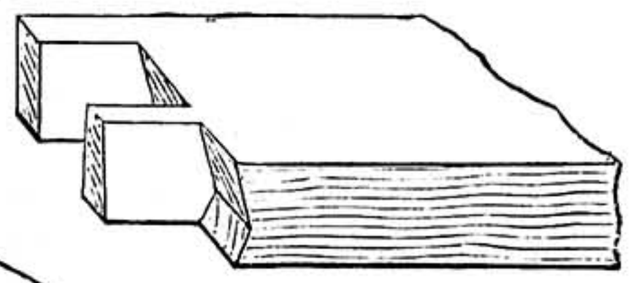


Fig. 2.—Dovetail Joint badly cleaned out.

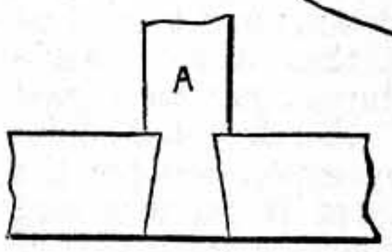


Fig. 7.—Dovetail Halving.

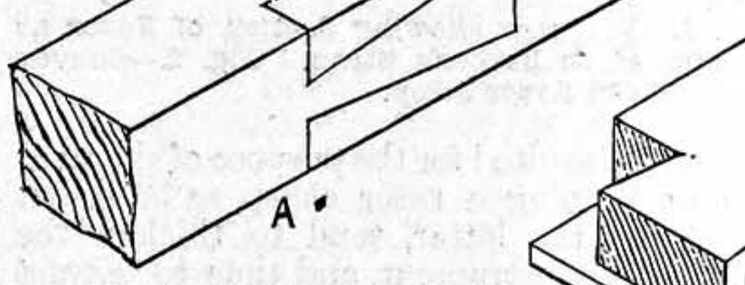


Fig. 9.—Block with Dovetail on Four Sides.

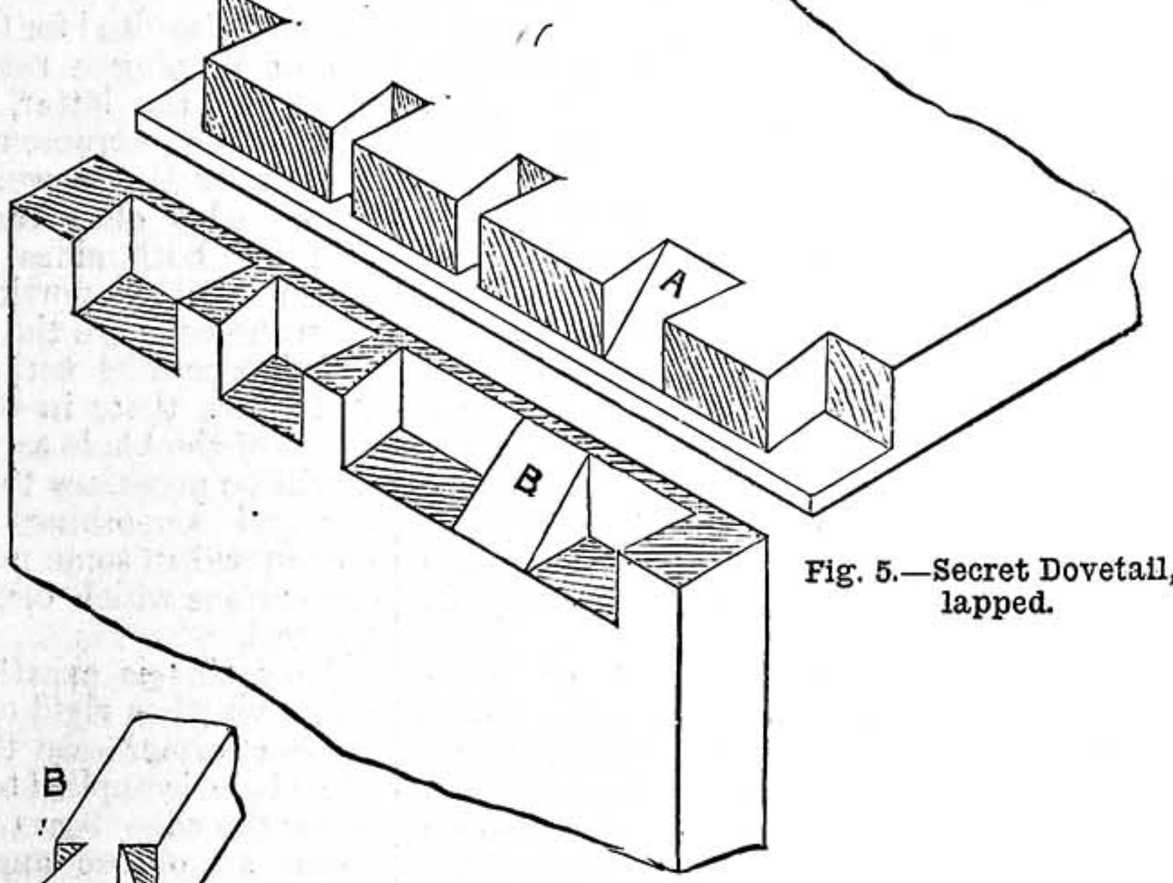


Fig. 5.—Secret Dovetail, lapped.

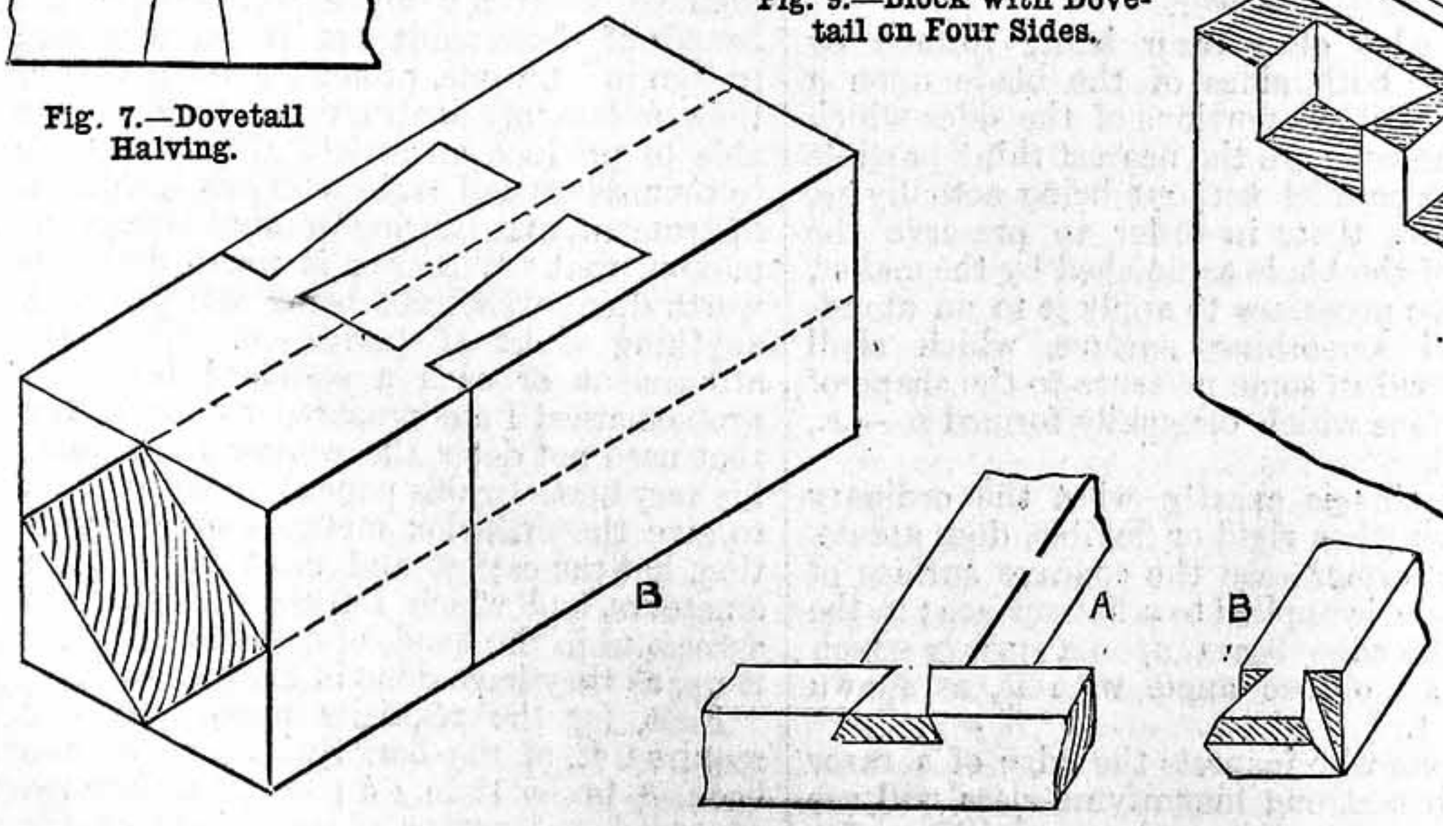


Fig. 8.—Halving Dovetailed both ways.

outside. Another bad practice is to leave the pins long, and rivet them over with the hammer when the joint is glued up.

Spacing.—The maximum strength would be gained by having the pins and sockets equal; but this is scarcely ever done in practice, the mortise being made so that the saw will just clear at the narrow side, the space being from eight to ten times the width of the widest side. Small pins are used for the sake of appearance, but fairly large ones are preferable. The outside pin should be larger than the others, and should not be too tight, or there is danger of its being split off, as shown at A, Fig. 3. In all dovetailed joints the angle should be slight, and not acute (as shown in Fig. 3). This looks strong, but is not so, as there is danger of the pieces, B, B, being split off in putting together.

Position of Pins.—When boxes are made the pins are generally cut on the ends, the sockets being on the sides. Drawers have the pins on front and back, the rule being to have the bevelled parts so that they are in opposition to the greatest stress that comes upon the piece of work to which the joint is applied.

Lap Dovetail.—Fig. 4 shows this joint, which is used for drawer fronts, the end grain being concealed on one side.

Secret Dovetail, Lapped.—Fig. 5 shows this joint, the end grain being almost concealed. The pin B is mitred, A being cut to correspond. This joint would be suitable for a work-box, the joint of the lid coming through B, so that when open it has the appearance of a mitred joint. This is a good form of joint, is more easily made than Fig. 6, and if, after gluing up, the edge be rounded, it equals it in appearance. In making this joint, first cut the pins, then the lap, and mark the sockets with the scriber.

Secret Dovetail, Mitred.—This joint (Fig. 6) is the most difficult to put together. The top pin is mitred right across, for the sake of appearance. In making this joint, both parts must have a lap or rebate cut on them, similar to the socket part of Fig. 5. Then the construction will be nearly the same, with the addition of mitreing.

Dovetail Halving.—This joint (Fig. 7) is objected to by some writers, because when A shrinks it will depend for its support on the screw, nail, or bolt, as the case may be. Then the dovetail form will be of no assistance in strengthening it, but will be a source of weakness at the shoulder, and the more the joint is bevelled the weaker it will be.

Halving Dovetailed both Ways.—Fig. 8 shows this. A gives the appearance, and the method of putting together may be gathered from B.

Block apparently Dovetailed on Four Sides.—This is shown at Fig. 9. A shows the block, and B the method of dovetailing. The pieces are dovetailed together with two pins, and then faced up to the smaller section shown on the end of B, which gives the appearance shown at A.

The two last-mentioned joints are of no practical value, but are rather curious. Many other applications of the dovetail are used, but cannot be described for want of space; but the columns of "Shop" are always open to the reader who requires advice. Amateur wood-workers are more disposed to nail ends of a box, for example, to sides instead of connecting them by dovetail joints. This may be all very well for rough work, but in joinery and cabinet-making the dovetail joint is much to be preferred.

ANOTHER HINT ABOUT RAZOR STROPS.

BY OPIFEX.

In page 7, No. 105, of the present volume of Work, P. B. H. gave some very useful hints on the subject of stropping a razor which should prove acceptable to many, as we may safely say there is no mechanical process—except the use of a knife and fork—in which so great a number of men are daily engaged all the world over. And yet, as far as my observation goes, comparatively few know how to perform this simple operation to the razor's advantage.

The wonder is that so many razors shave at all, and the credit of their doing so is certainly due to the makers of the instrument rather than to the users in the great majority of instances. With regard to the use of the strop described by P. B. H., little can be added to his remarks; the only exception I take to them being that he recommends "flour of emery" to be applied to the strop, for if the ordinary flour emery of commerce be thus used, the result will be disastrous to the razor. The fact is that nothing but the most perfectly levigated flour of emery should ever be used upon a strop.

My object in writing, however, is to suggest that neither P. B. H.'s strop, nor the common strop of leather, etc.—used by

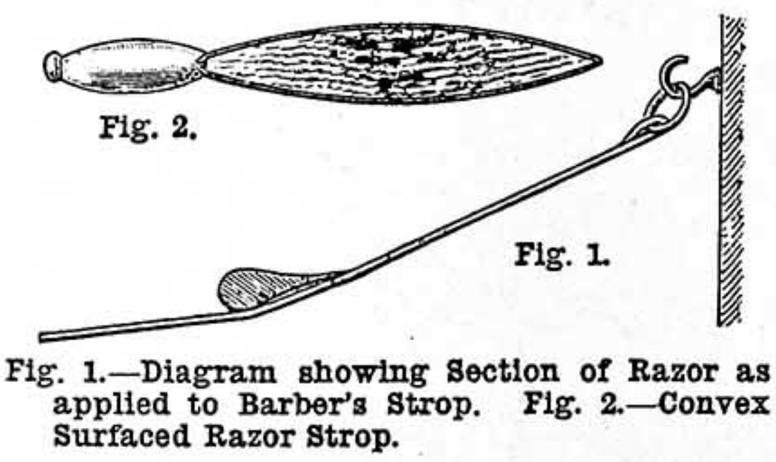


Fig. 1.—Diagram showing Section of Razor as applied to Barber's Strop. Fig. 2.—Convex Surfaced Razor Strop.

barbers—is suited for the purpose of sharpening or keeping a razor sharp, as both, but especially the latter, tend to thicken the edge of the instrument, and thus to detract from its cutting power.

The edge of a razor being formed by grinding both sides of the blade upon a wheel until the portions of the sides which form the edge are the nearest thing possible to being parallel without being actually so, it follows that, in order to preserve the shape of the blade as finished by the maker, it will be necessary to apply it to an abrading and smoothing surface, which shall correspond in some measure to the shape of the surface which originally formed it—*i.e.*, a wheel.

Now, this is exactly what the ordinary strop, whether rigid or flexible, does *not* do. In the former case the concave surface of the blade is applied to a flat surface; in the latter the edge bears upon a surface which forms an obtuse angle with it, as shown in Fig. 1.

Anyone who inspects the edge of a razor through a strong magnifying-glass will see that it consists of irregular teeth, like a very jagged saw, and will be able to appreciate the effect produced by either of the methods alluded to.

By frequent stropping these teeth are bent from side to side, until they are eventually broken off, and the edge becomes smoother, but considerably thicker, and, therefore, comparatively blunter.

To obviate this result, I suggest the use of a strop (about sixteen inches long, including the handle) shaped as represented at Fig. 2. The "body" of the strop is of mahogany, and is covered with finest buff leather or buckskin—in my case made from one of an old pair of braces; it is coated on one side with finest jeweller's rouge and blacklead, made into a paste with suet; the other side is the plain leather. Use it as directed by P. B. H. in the article already quoted; I have done so every day, with very rare exceptions, for ten years, and have never had my razor ground or "set" in all that time, because the original edge has been *preserved*.

THE ZITHER: HOW TO MAKE IT.

BY R. F.

Introduction—Wood—Patterns—Construction of Instrument—Various Parts—Fitting of Parts—Gluing Parts Together—Bridges—Finger-Board—Marking Frets—Cleaning up and Feet—Pins and Wrest-Pins.

How well I remember the first time hearing a zither played! I was staying at a London hotel during the Exhibition of 1871, and in the small hours of the morning was awakened by the strains of "She wore a wreath of roses!" most exquisitely played. What manner of instrument was being used I had no idea, and thought at first it was one of those delicate musical-boxes with reeds; but, from the expression used and the subdued accompaniment so unattainable by mere mechanism, I was soon led to alter my opinion, and the introduction of an addition to the melody decided me that someone of the *genus homo* was concerned in its production. Inquiry in the morning disclosed the fact that "Julius," the night attendant, was wont thus to beguile the weary hours, and soon I had the satisfaction of examining the instrument, whose strains had so captivated my fancy a few hours before. A desire to possess one was soon followed by its acquisition, and an idea of improving upon it led me first to try and construct one. Since then I have made several, which have turned out very good instruments; and I therefore feel quite justified in giving my experience for the benefit of those readers of Work who care to "go in" for one, promising them that if they follow my instructions, they will be able to produce an article alike creditable to themselves and satisfactory as a musical instrument, and, bearing in mind always the maxim, that "Whatever is worth doing, is worth doing well," not being satisfied with anything short of perfection. That the attainment of such a standard is highly problematical I am prepared to admit, but that need not deter the worker from doing his very best. In this paper I do not pretend to give the orthodox methods of construction, but the easiest and most suitable for amateurs, and which I trust will prove as successful in the hands of any who may take it up, as they have done in my own case.

First, for the requisite wood, you will require 2 ft. of the best Swiss pine for the back, $\frac{3}{16}$ in. by 12 in.; a piece of mahogany, rosewood, or another piece of pine of the same thickness for the belly; a strip of maple or sycamore, $\frac{3}{16}$ in. by $\frac{7}{8}$ in., and 24 in. long, for the ribs on the curved side; another piece of the same for the straight side, 19 in. long; a piece of pine for the stays, 15 in. long by $\frac{3}{4}$ in., and about 3 in. wide; a piece of beech for the blocks, 10 in. long, $\frac{3}{4}$ in. thick, and 5 in. wide; a piece of ebony, 13 in. long, $\frac{3}{16}$ in. thick, and $2\frac{1}{4}$ in. wide, for the finger-board; another piece of the same,

7 in. long and 1 in. wide, from which to get out the upper bridge; a piece of ebony or rosewood, $\frac{3}{8}$ in. thick, 1 in. wide, and $8\frac{1}{2}$ in. long, for the lower bridge; and a small piece, from which to make three knobs for feet. Rather a formidable-looking list for such a small instrument, but nothing so very alarming after all, when the quantities of each are considered. Note particularly that all the *thicknesses* here given, with the exception of the stuff for the stays, are for finished material, as it will be required; but lengths and widths are given a little more than wanted, to allow for working. In addition to the stuff necessary for the instrument itself, you will require a piece on which to build, unless you prefer to use your bench-top for the purpose. This piece must be 24 in. in length and 18 in. wide; any thickness not less than $\frac{3}{4}$ in., and must be planed true on one side; and, lastly, a piece of $\frac{3}{4}$ in. by 6 in. wide, and 24 in. long, for a mould for the curved side; and a few more odd pieces of $\frac{1}{2}$ in. stuff, which will be mentioned as we go along.

Commence by getting out a stiff paper pattern from Fig. 1, and cut this out. Cut off $\frac{1}{4}$ in. from the bottom edge; then turn it over, and on the reverse side mark the position of all blocks, stays, and the sound-hole, as shown at Fig. 2; cut the sound-hole out, and your pattern is ready. Now take the pieces intended for the back and belly, which have been reduced to the thickness previously given, and mark on them all round the pattern; cut these out, and shape them up exactly alike, leaving the edges perfectly square. Lay the back on one side, and, taking the belly, lay it face downward on the slab or bench, and fasten it there by two screws, through the place where the sound-hole will be. Put these screws through another piece of wood, about $\frac{1}{2}$ in. thick and 2 in. wide, first, as the belly itself is not strong enough. Now take your piece of beech, 5 in. by 10 in. by $\frac{3}{4}$ in., and lay your pattern on, and mark along the top; then shift it $2\frac{1}{2}$ in. lower, and mark again; then mark off $\frac{3}{16}$ in. from each end, and this will give the pattern for the wrest-pin block, A, Fig. 7; and from the remaining piece can be got the lower block, $1\frac{1}{2}$ in. by 8 in., B, Fig. 7. Square the edges of these, and lay the upper block in its place at the top of the belly, flush with the top edge, and leaving $\frac{3}{16}$ in. at each end for the ribs to come on. Now lay the lower block in its place, and mark where the end of the curved rib will come; then cut a piece $\frac{1}{2}$ in. deep and $\frac{3}{16}$ in. wide out of the end of the block, for the end of the rib to fit into, as shown at Fig. 2. This block is now ready, and both it and the top one may be glued into their places, and weighted down till dry. When doing this, take care that the $\frac{3}{16}$ in. of the belly are left at *each* end of the upper block, but at the straight end of the lower block only. Before these blocks are glued on, you must be careful to have them well warmed, and also take care that your glue is perfectly hot, clean, and strong, but not thick. While they are drying you may get out your two diagonal stays, the shape of which is shown at Fig. 4, and a section in its centre at A′. These, you will observe, taper off to nothing at each end, and go quite across the belly, the lower one starting from a point $5\frac{1}{2}$ in., and the upper one $10\frac{1}{2}$ in., from the bottom on the straight side, and being carried across to points, $2\frac{1}{2}$ in. lower, on the opposite side. They should be $\frac{1}{2}$ in. deep in the centre, and $\frac{1}{2}$ in. wide throughout. They may be glued on, and cramped down by a button at each end, and by the piece that is already holding the belly down to the board being taken off, and its position altered, of course, using longer screws for this purpose. Fig. 8 shows this arrangement at A. The next parts to get on are the ribs, and for this a mould is required. The piece of wood, 6 in. wide, 24 in. long, and $\frac{3}{4}$ in. thick, will be required for this. On it lay the curved side of your pattern, and mark along its edge; then cut it out, and clean up the *hollow* side, and, taking up the buttons from the ends of the stays, screw this down side by side with, and exactly fitting, the curved side of the belly. The remaining piece can be screwed down at the straight side, and you will then have the belly in a mould. On the top of these pieces screw buttons of wood, about 2 in. long and 1 in. wide, at intervals of 3 in., and the arrangement is complete.

Before gluing in the ribs, it is as well to see that everything fits properly. Take, therefore, the slip you have prepared for the ribs, and reduce it to $\frac{3}{4}$ in. wide; then insert one end in the groove in the lower block, and gently bend it round the curved side, screwing the buttons down on to it as you proceed. If the wood is harsh or brittle, it will be as well to damp it before doing this. Mark the places where the ends of the diagonal stays come; take the slip out again, and cut out the little pieces that may be necessary; then replace it, and fit accurately. The straight side must be fitted in the same manner; and when this is done, the ribs may be glued in and cramped down, and the whole be left to dry (Fig. 8). The interior construction is now nearly complete, requiring only the addition of the long stay or inner bridge, C, Fig. 2. This is $13\frac{1}{2}$ in. long, $\frac{3}{4}$ in. deep, and $\frac{5}{8}$ in. thick, and must fit tightly between the top and bottom blocks. Two curved pieces are cut out of the under edge to give lightness to it, and two square pieces out of the upper edge to receive the diagonal stays; and if the blocks are thoroughly dry, this long stay may be glued into its place. Another interval for drying, and the cramps may all be taken off, the shell taken out of the mould, and the sound-hole cut. This is $3\frac{1}{2}$ in. in diameter, and must have its edges neatly rounded. A straight-edge must now be passed over the blocks, ribs, and stay, to see that all are exactly level, and any inequality must be rectified. When all is ready, the back may be prepared for fixing. Glue a small block, 1 in. square and $\frac{1}{4}$ in. thick at the widest part of the inside of the back, $\frac{3}{16}$ in. from the edge; this is to take the stem of a foot that will afterwards be fastened in. Mark on the outside of the back where the centre of this block comes. Now replace the shell in the mould, and refix the buttons in their places, turning them to one side to leave the top edges of the ribs bare. All being ready and your glue quite hot, pass a warm flat-iron several times over the blocks to get them warm; then glue quickly all the points of contact with the back—*viz.*, the blocks, the edges of the ribs, and the feet of the long stay; and, as soon as this is done, clap the back on, and weight down at top and bottom; turn the buttons into their places, and screw down. As this operation of getting on the back is a very important one, it being absolutely necessary that the contact with all the points should be perfect, it is better not to attempt it by one's self, but to get a little assistance. When all is quite dry, the instrument may be taken out of the mould, the edges cleaned up, and, with the back and belly, thoroughly smoothed with glass-paper. When this is done, prepare the bridges and finger-board. First cut out your upper bridge from the piece of ebony, 1 in. wide and 7 in. long. This bridge, when finished, is $\frac{3}{8}$ in. wide and $\frac{3}{16}$ in. thick, and has a small groove cut in at a distance of $\frac{1}{8}$ in. from the front edge, to take a piece of No. 18 brass wire, over which the strings are to pass. This is the pressure-bar, A, Fig. 5. Glue this bridge on with its bottom edge $2\frac{1}{3}$ in. from the top edge of the wrest-pin block, and its left end $2\frac{1}{8}$ in. from the straight side; the remaining distance to the edge will be occupied by the finger-board. The lower bridge may now be got out of the piece of ebony or rosewood, 1 in. by $\frac{3}{8}$ in. by $8\frac{1}{2}$ in.; and this, when finished, should be of the exact size and pattern as shown in the drawing D, Fig. 6, and the exact length of the straight part at bottom of instrument. The strings do not pass *over* this bridge, but partly over and partly through it—over it as far as the pressure-bar, and then through channels to where the bridge joins the top edge of the belly. The first five channels are cut at intervals of $\frac{3}{8}$ in. from each other, leaving $\frac{5}{16}$ in. of the finger-board on the outside of the first and fifth strings respectively; then a further interval of $\frac{1}{8}$ in., and divide the remainder of the bridge, leaving $\frac{1}{4}$ in. at the bass end, into twenty-six equal parts. These marks, which will be about $\frac{7}{32}$ in. apart, must be sawn through diagonally (as shown in Fig. 6) from the pressure-bar to the belly, and the lower of the channels thus made must be wider than the others, as the strings going through them will be thicker. It is better, perhaps, to glue the bridge on (leaving $\frac{1}{4}$ in. projecting over the end), and let it dry before cutting through it, as it is less liable to fracture then. The finger- or fret-board may now be taken in hand. This, when finished, should be 13 in. long, $2\frac{1}{8}$ in. wide, and $\frac{3}{16}$ in. thick. At a distance of $\frac{1}{4}$ in. from the top draw a line across, and on this line cut a groove $\frac{3}{32}$ in. deep. That is exactly half-way through the board. In this groove insert a piece of sheet brass or German silver, which must project $\frac{1}{8}$ in. above the top surface. This forms the nut, and from the *front* edge of this all the distances for the other frets are measured. Directly at the back of this nut five holes are drilled, sloping to the left, in which to insert the nut pins. These holes correspond to the five channels in the lower bridge, in being $\frac{3}{8}$ of an inch from each other. Now you may proceed to mark off the finger-board for the frets, the distances here given being from the *front* edge of the nut to the *centre* of each fret, so that the mark must in each case be cut out:—

1st.—$\frac{7}{8}$ in.	16th.—$9\frac{3}{16}$ in.
2nd.—$1\frac{11}{16}$ in.	17th.—$9\frac{9}{16}$ in.
3rd.—$2\frac{7}{16}$ in.	18th.—$9\frac{7}{8}$ in.
4th.—$3\frac{3}{16}$ in.	19th.—$10\frac{3}{16}$ in.
5th.—$3\frac{13}{16}$ in.	20th.—$10\frac{3}{8}$ in.
6th.—$4\frac{7}{16}$ in.	21st.—$10\frac{3}{4}$ in.
7th.—$5\frac{1}{16}$ in.	22nd.—11 in.
8th.—$5\frac{5}{8}$ in.	23rd.—$11\frac{1}{4}$ in.
9th.—$6\frac{3}{16}$ in.	24th.—$11\frac{1}{2}$ in.
10th.—$6\frac{11}{16}$ in.	25th.—$11\frac{11}{16}$ in.
11th.—$7\frac{3}{16}$ in.	26th.—$11\frac{7}{8}$ in.
12th.—$7\frac{5}{8}$ in.	27th.—$12\frac{3}{16}$ in.
13th.—$8\frac{1}{16}$ in.	28th.—$12\frac{1}{4}$ in.
14th.—$8\frac{1}{2}$ in.	29th.—$12\frac{7}{16}$ in.
15th.—$8\frac{7}{8}$ in.	

When all are marked, proceed to cut carefully each one to $\frac{3}{32}$ in. deep, except Nos. 23 and 25, which are short frets, and only go half-way across the board. For this purpose a very fine dovetail saw must be used. Having cut all the grooves, fill in each one with a piece of the same metal, as

previously used for the nut, allowing $\frac{1}{16}$ in. only to remain above the surface. To fasten these frets in their places securely, take a small quantity of shellac, crush it to powder, and place a little in each groove, then heat the fret by holding it in a flame, and place it quickly in position. Note, do not make it red-hot, or it will burn the shellac instead of melting it. The rough edges and the ends of these must be rounded off, and the dots or stops may be inserted. These are of ivory or pearl, $\frac{3}{16}$ in. diameter. Two are inserted half-way between the fourth and fifth, the eighth and ninth, the eleventh and twelfth, and the eighteenth and nineteenth frets; one on each side of the board; and one between the fourteenth and fifteenth, in the centre. These dots are guides to fingering (Fig. 1). The board may now be placed in position. First, warm it well; then glue it over, and quickly lay it in its place, giving it a rub up and down to set the glue, and taking care that the nut is level with the groove in the upper bridge, and the outer edge flush with the straight side. Clean off the glue that has squeezed out, and set aside for a few hours to dry. The whole may now be thoroughly cleaned up; the holes bored in the back for the insertion of the feet, one at top and one at bottom of straight side, and one at the widest part of the curved side, where you have a block ready for it. These feet are small round knobs, $\frac{1}{2}$ in. in diameter, with a stem $\frac{1}{4}$ in., and when in position have a sharp little spike of iron projecting from the bottom, to prevent the instrument slipping about on the table when being played. The back and ribs may now be stained and the instrument polished, unless you wish to try your hand at purfling. In this case you will require a purfling chisel and about 4 ft. of purfling, to go round the curved side and the sound-hole. When polished, the wrest-pin block may be bored. First, bore the holes for the melody strings. A reference to Fig. 1 will show where these are to be, and care must be taken that they are a little to the right of the holes for the nut pins. The pins for the accompaniment strings occupy the centre portion of the block, are $\frac{7}{16}$ in. apart, and are placed in two rows, $\frac{3}{4}$ in. apart, the pins of one row alternating with those of the other, and the whole sloping slightly to the top of the block. After boring they should be slightly countersunk. The bridge-pins of the accompaniment strings are $\frac{7}{32}$ in. apart, and slope to the right. All these bridge-pins should be made of No. 20 brass wire, and be $\frac{5}{8}$ in. in length, with $\frac{1}{8}$ in. left above the bridge. The holes for them should be drilled, not bored. The wrest-pins are of a special kind, and can be bought for a small sum. They can be had either in blue steel, polished steel, or nickelled. Messrs. W. J. Chilvers & Co., St. Stephen's, Norwich, supply them, as well as all other fittings, strings, etc. The work now remaining is the insertion of the hitch-pins, which are shown at E, Fig. 6. The lower row consists of the first five strings only, and are put in in a straight line, the other two rows alternate with each other, and the whole corresponds to the thirty-one channels through the lower bridge. These pins are made of No. 17 wire, are $\frac{5}{8}$ in. long, and are driven into the block for $\frac{1}{2}$ in. Now fit a piece of the No. 17 wire into the groove in each bridge, and the instrument is ready for

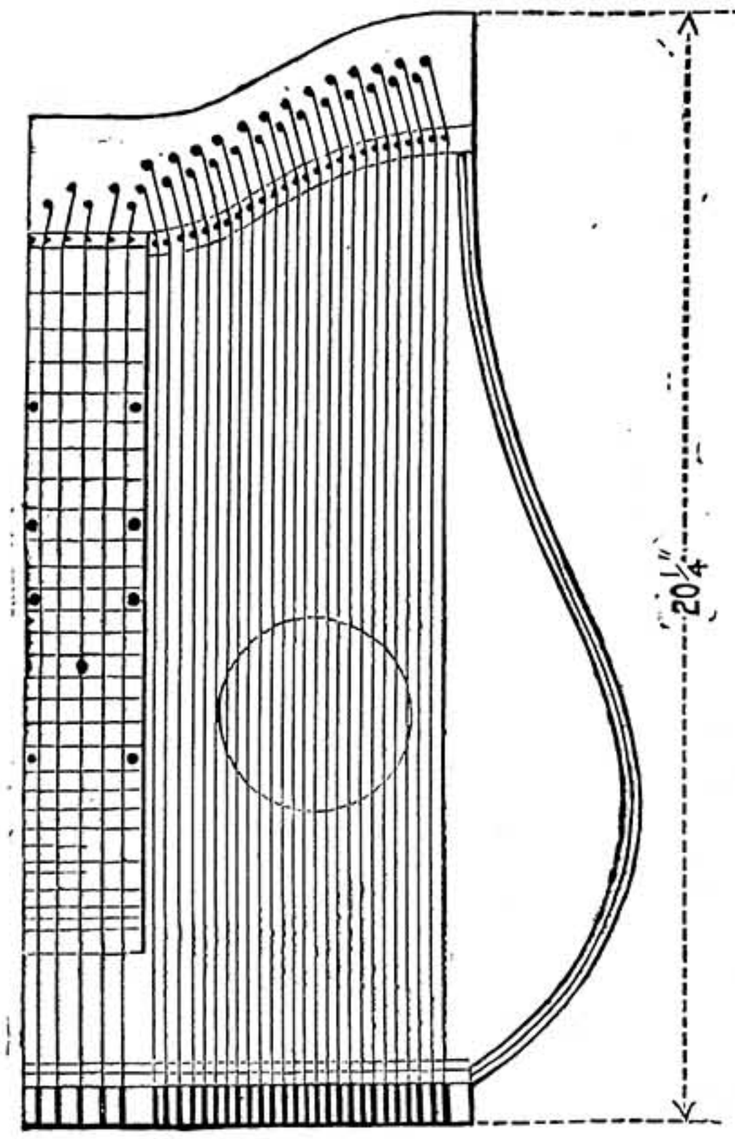


Fig. 1.

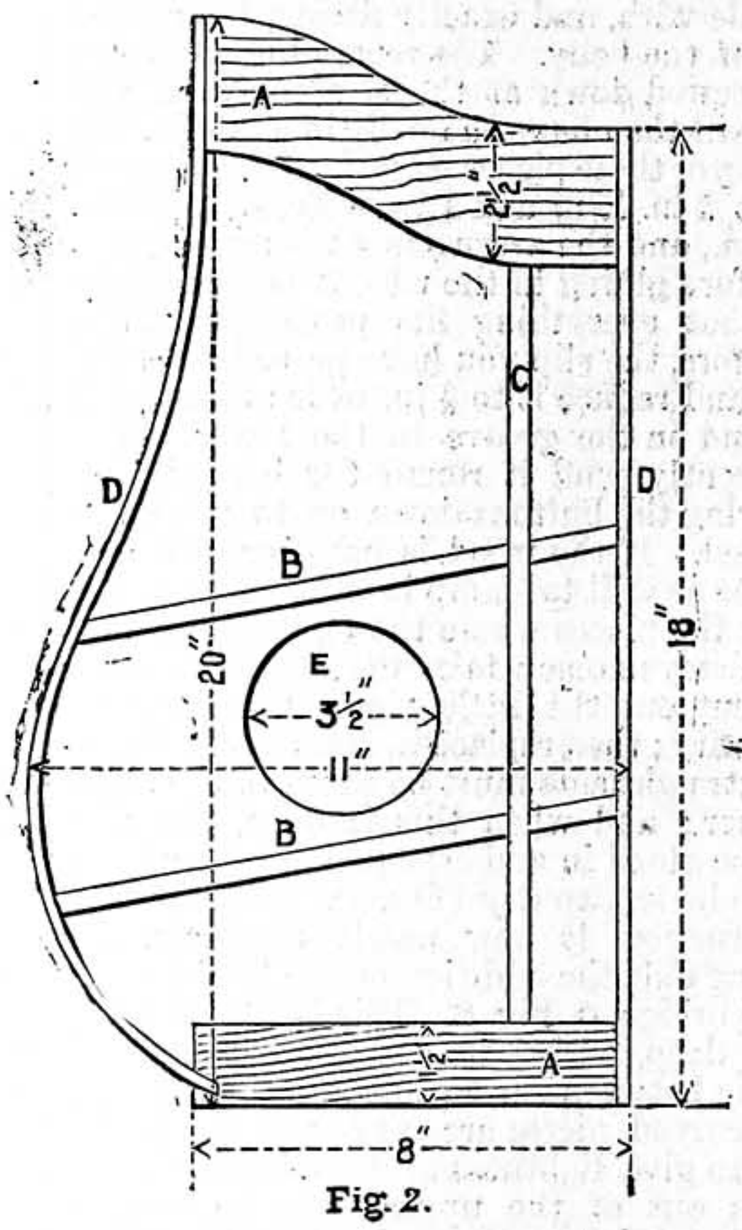


Fig. 2.

Fig. 3.

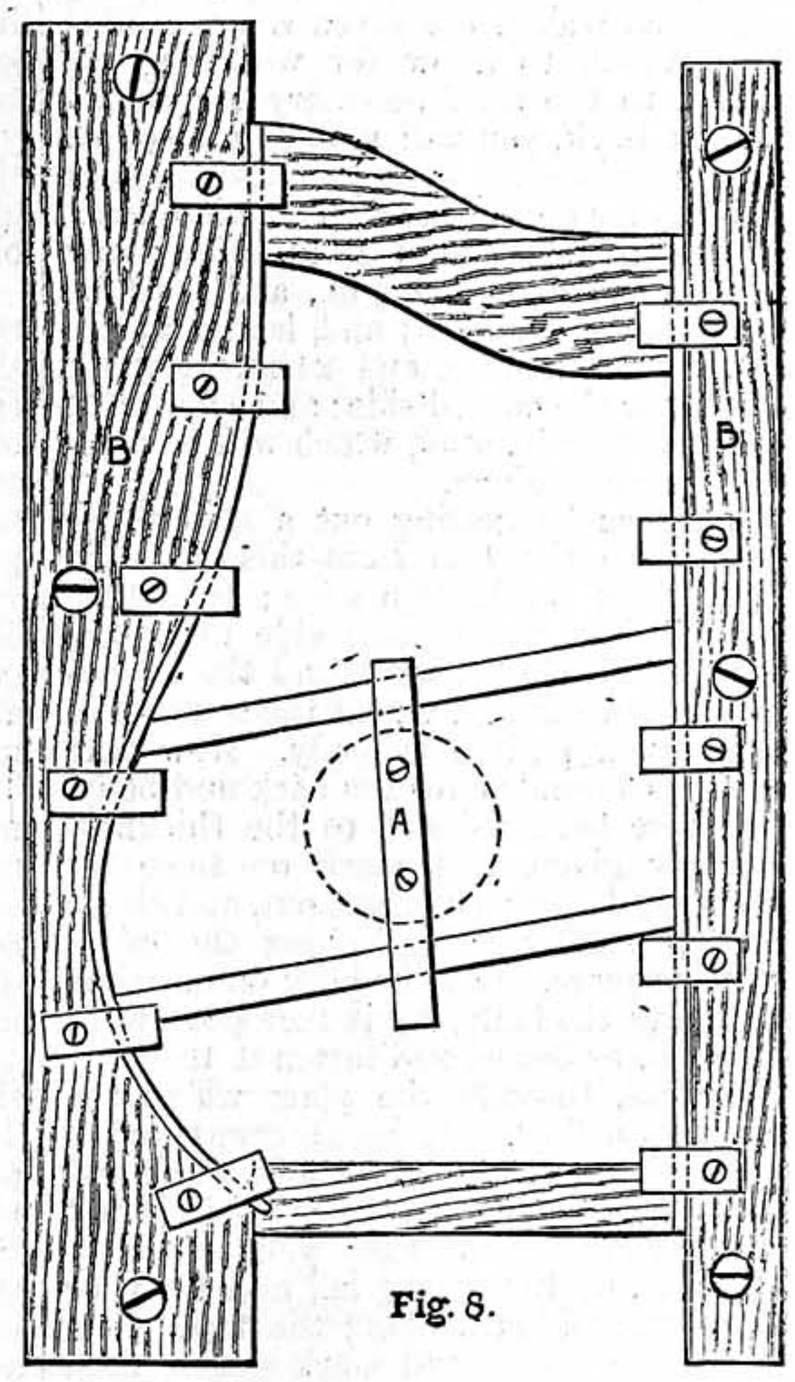
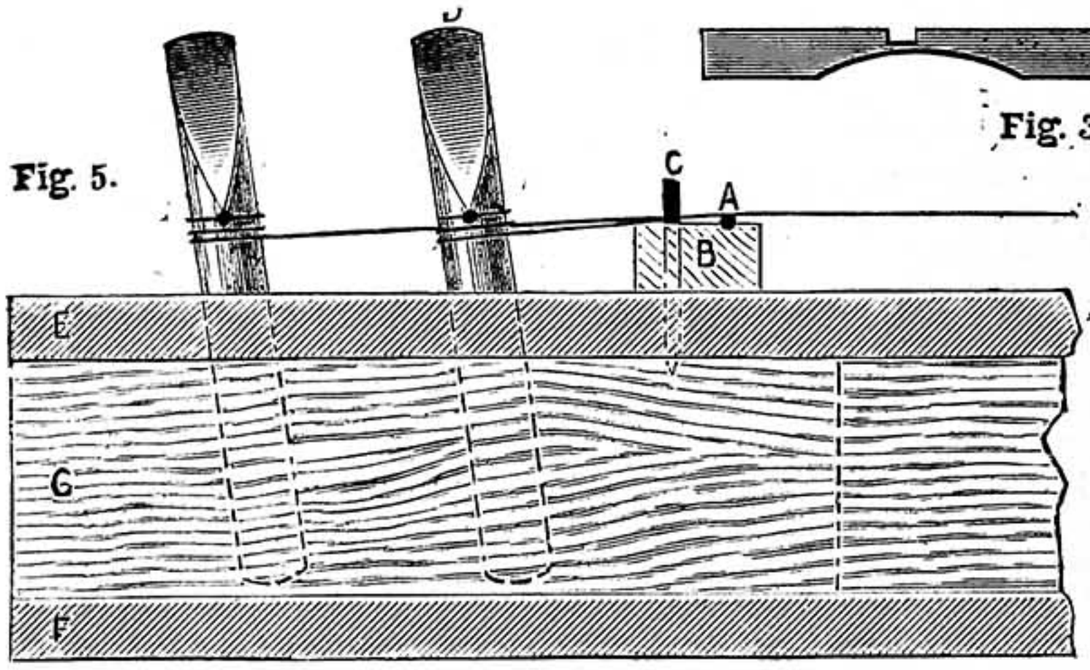


Fig. 8.

Fig. 5.



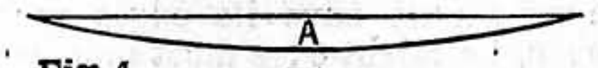


Fig. 4.

Fig. 7.

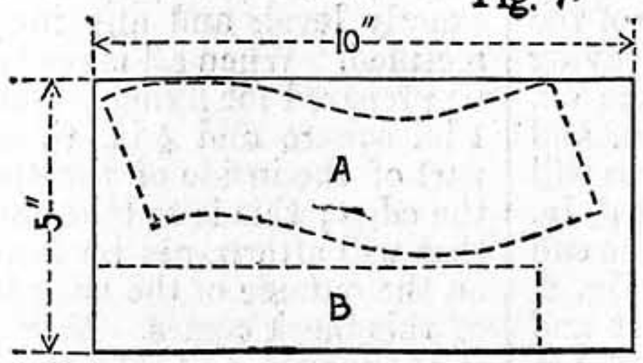


Fig. 6.

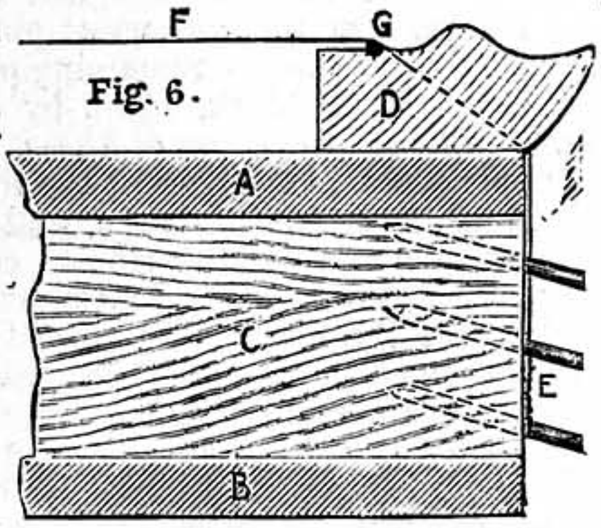


Fig. 1.—General Plan of Zither, on Scale of 2 in. to 1 ft. Fig. 2.—Plan of Underside of Belly, showing Arrangement of Blocks (A, A), Diagonal Stays (B, B), Long Stay (C), Ribs (D, D), and Position and Form of Sound-Hole (E), on Scale of 2 in. to 1 ft. Fig. 3.—Elevation of Long Stay on Scale of 2 in. to 1 ft. Fig. 4.—Elevation of Diagonal Stays—A′, Section at A, on Scale of 2 in. to 1 ft. Fig. 5.—Full-Size Section of Upper Block and Bridge (B), with Pressure-Bar (A), Bridge-Pin (C), Wrest-Pins (D, D), Belly (E), Back (F), and Block (G). Fig. 6.—Full-Size Section of Lower End of Zither, showing Direction taken by Strings (F) through Lower Bridge (D); Other Parts shown being Belly (A), Back (B), Block (C), Hitch-Pins (E), and Pressure-Bar (G). Fig. 7.—Method of cutting out Top Block (A) and Bottom Block (B), on Scale of 2 in. to 1 ft. Fig. 8.—Method of cramping down Ribs and Stays—A, Stay Cramp, also holding down Belly to Board; B, Mould with Buttons.

stringing. In stringing, take care to turn the pins to the left, as all the tuning is done with the left hand, when the instrument is in use. To learn to tune the zither it is necessary to have a scale, and these are always to be found in good instruction books. Procure one of these, and study it attentively.

WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

THE WORM BLOCK—TYING—FRAMES—KNUCKLES.

SPIRAL springs are extensively used for various purposes, such as for salad or vegetable ladles, etc. They are usually made by the aid of an article called a "worm block." In Fig. 70 I have shown the appearance presented by such an adjunct, which is, in this diagram, supposed to be rigged up with the intention of being secured in a convenient position on the bench, although frequently it will be observed that the block is fitted to a very plain framework, with no view of being secured to the bench, but in order that it may be fixed to the vice when required for use, and always be regarded as a loose tool. Of course, the reason for this being the case in some shops is obvious enough: where a bench has several machines or tools upon it as fixtures, there is likely to be far less clear space for the workman than would be considered by him to be necessary; and, further, such tools, etc., as fixtures, would always be exposed to sundry knocks from the wire-work under manipulation, and, perhaps, in this manner receive more damage than would be the case were they made so that they might be placed underneath the bench during the non-requirement of them.

The worm block which I inspected was composed of a hard wood. It was about 7 in. or 8 in. long, 3 in. or 4 in. thick at one end, tapering to a point, as shown in Fig. 70, at the other end. Beginning at the point, a groove was worked around it completely to the other end, thus making a worm or spiral line upon it. Wires of various gauges can be used, provided the groove is, of course, made deep and wide enough for the purpose.

If to be fastened to the bench, it should be mounted upon standards, as shown. For these there will first be a H iron foot, with screw-holes in it. At each side there will be a support in the shape of a perpendicular iron rod, the bottom end of which will be welded into the foot, while the top end will receive an end of the handle-bar. Of the handle-bar I have not previously spoken. It will be an iron rod, bent as in Fig. 71, and driven through the middle of the worm block in such a way that there will not exist the remotest possibility of the latter working at all loose. That this should be the case is a very essential matter.

For the better utilisation of the machine, it will be advisable to firmly fix a wooden handle over the proper part of the handle-bar.

The ends of the uprights which are to receive the handle-bar will be bent as in Fig. 72. At each side, in addition, will be a half-circular iron rod, the top of which will be as in Fig. 73: so made in order that it may receive the perpendicular supports, and thus tend to strengthen the machine without creating inconvenience by arousing any possibility of the wire being worked getting entangled in any way.

If it is desired that this machine shall be a loose article, nothing more than a simple

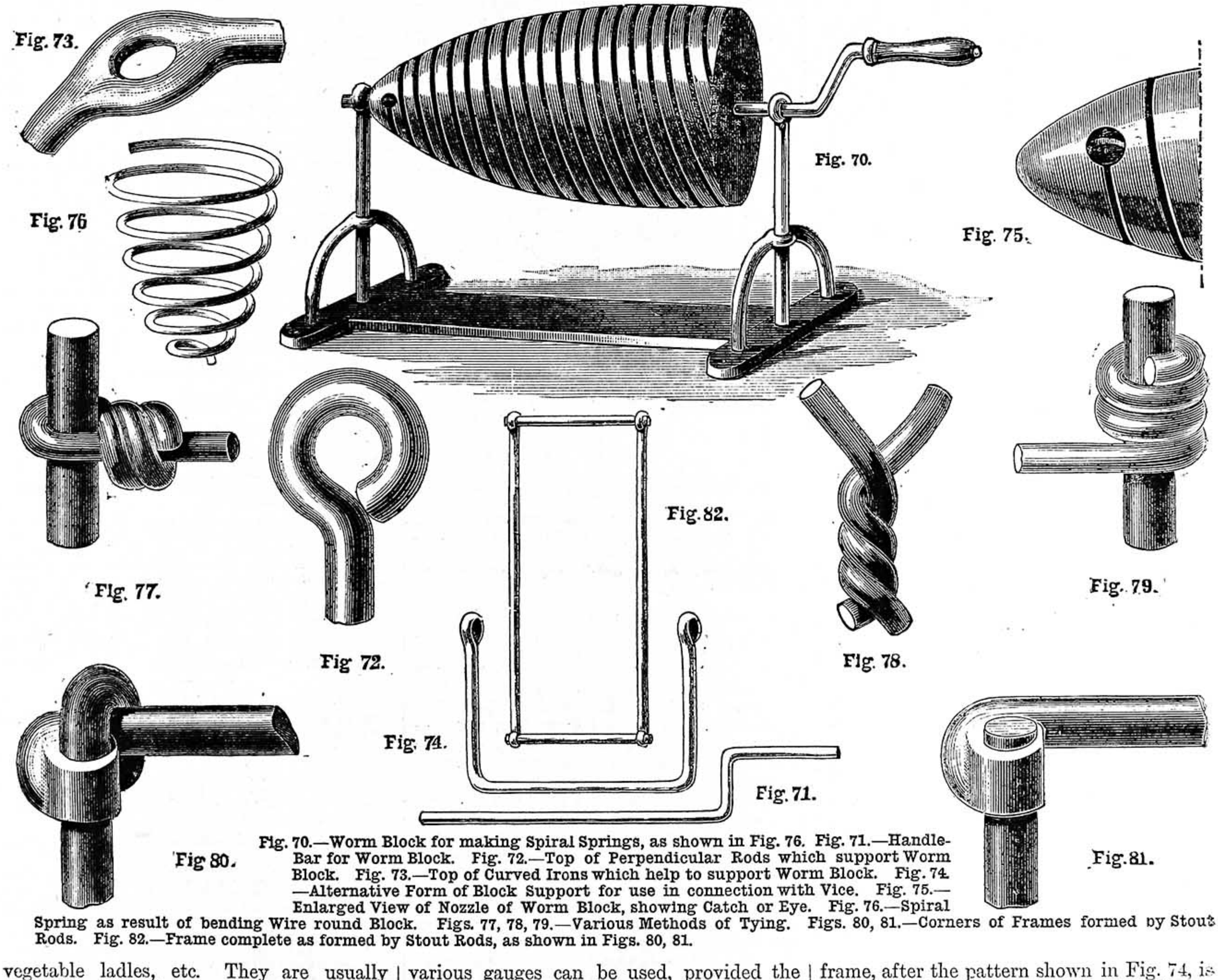


Fig. 70.—Worm Block for making Spiral Springs, as shown in Fig. 76. Fig. 71.—Handle-Bar for Worm Block. Fig. 72.—Top of Perpendicular Rods which support Worm Block. Fig. 73.—Top of Curved Irons which help to support Worm Block. Fig. 74.—Alternative Form of Block Support for use in connection with Vice. Fig. 75.—Enlarged View of Nozzle of Worm Block, showing Catch or Eye. Fig. 76.—Spiral Spring as result of bending Wire round Block. Figs. 77, 78, 79.—Various Methods of Tying. Figs. 80, 81.—Corners of Frames formed by Stout Rods. Fig. 82.—Frame complete as formed by Stout Rods, as shown in Figs. 80, 81.

frame, after the pattern shown in Fig. 74, is required; for, attached to such a frame, when use were being made of it, it could be screwed up tightly in the vice by one corner.

At the pointed end of this block, at about the spot indicated in Fig. 70, will be a small hole, across the opening of which will be a little staple or piece of wire, as in Fig. 75. When the wire is about to be bent to the form of a spiral, the swift upon which the coil is placed must be fixed in a handy position for working from. One end of the wire is then hooked to the catch described in the point of the worm block, and guided in the groove. It will require little intelligence to perceive now how, when the handle is turned—the wire, of course, being properly

guided—is entwined around the worm block, and when cut off at the required length and released, a spiral spring is formed.

Supposing that the wire is worked round the block for a third of the latter's length, when cut and released it would be found that it will spring out considerably, thus increasing in width and shortening in length, although it can be turned with the fingers to the proper size again. If it were not for this "springy" conduct on the part of the turned wire, it would be a very troublesome experience for a workman to release it from the block. In Fig. 76 is proportionately represented a spiral spring, similar to what would result with our worm block.

This expression of "tying" can hardly be said to be correct, for what is generally understood to be tying, in connection with such material as string, is the fastening over and under of the parts to be secured. With wire it is different. If a single end of a wire is to be tied, it is turned round and twisted to itself, as in Fig. 77; and when the two ends of a wire, or a pair of separate ones, are to be united, they are twisted around each other, as in Fig. 78. Sometimes, when a thin gauge wire is used, the operation of tying can be accomplished by the aid of the fingers only; but if wire of any stoutness at all is used, it will be found that the pliers will have to be called into requisition. Another method of single-wire tying is that shown in Fig. 81, but, in my belief, it is not nearly so useful as that described in Fig. 77.

Hereafter, when I refer to "frames," I shall suppose that the reader will have acquainted himself with my notes upon them. Fig. 82 shows a frame. The term can be said to mean the skeleton of a job of any description, as, for instance, fire-guards or garden arches. According to the size of the article, so will be regulated the gauge of the rods composing the frame. The corners are made either as in Fig. 80 or Fig. 81. Sometimes the joint (Fig. 81) only is necessary. This is for small work, as the wires, when once turned over within the frame, hold all parts together, and with the additional strength afforded by stay-bars (of which more is said elsewhere) is all that is required; but for large work it is desirable to use the joint shown in Fig. 80.

The term "knuckles" is used in connection with turning over. That part of a wire which encircles a rod of a frame is a knuckle. When it is said that knuckles are inward, the meaning is that the wire is so bent towards the middle of the work as the article will appear when completed; and the same applies, in a reverse manner, when knuckles are said to be outward.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

59.—JACOB'S IMPROVED WINDOW-BOX.

NATURALLY enough, if one does not exactly like any article or appliance in every-day use, and further happens to be of a constructive and, may I say, alterative condition of mind, one tries to improve, on existing circumstances, and to make life in that particular direction more worth living. That this was the case with Mr. Thomas Jacob, Cabinet and Joinery Works, 31, Cleveland Mews, Fitzroy Square, his "Improved Window-Box" clearly shows; and a little reflection will show any reader who understands, and is fond of, gardening, that Mr. Jacob has made life more worth living for plants that are destined to pass their time, or the greater part of it, in a window-box, and for persons who have perhaps no opportunity of growing plants in any other way, by having made better provision than heretofore for keeping plants in a healthy state. When Mr. Jacob sent me his model for inspection, he wrote: "I took this matter in hand because I always regarded the ordinary window flower-box as an example of the most primitive and thoughtless construction to be met with, and although much expense has frequently been lavished upon it by the addition of artistic tiles, it cannot be said that the result is satisfactory. I therefore set myself the problem of producing a flower-box that should be efficient, as regards drainage and ventilation, artistic in form, of greater durability, and at the same time cheap. Ventilation and drainage, the most important objects,

Fig. 1

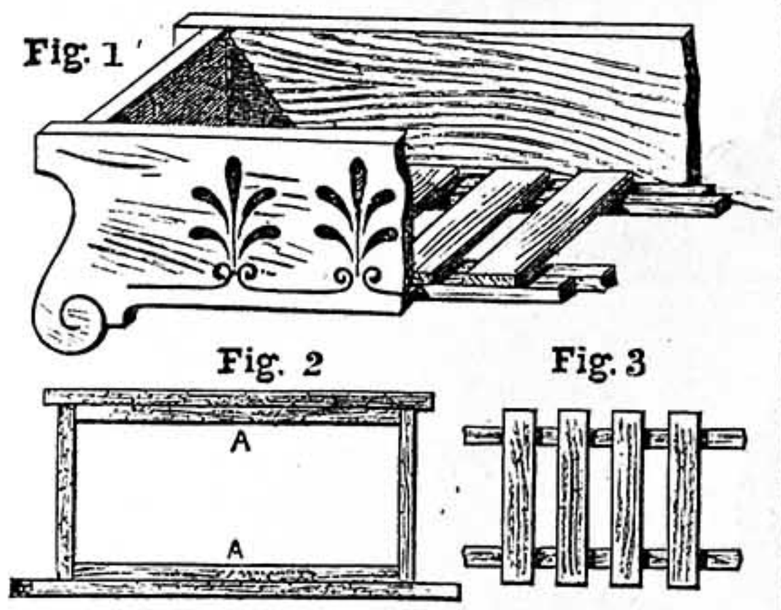


Fig. 1.—Diagram showing Construction of Box, and open and movable Bottom formed of broad Laths. Fig. 2.—Plan of Box seen from above—A, A, Ledges. Fig. 3.—Plan of Bottom.

are provided by a trellis bottom, which is raised about 1½ in. This, as a convenience of manufacture, and that it may be renewed if desirable, is loose. Improved form is obtained by allowing the front of the box to project beyond the ends of box, and shaping it. Inexpensive artistic effect is produced by a painted decoration, although tiles may be applied, if desired. With regard to the strength of this box, the improved method of construction ensures that, unless it is really broken to pieces, it will not give way. Such a box, 3 ft. 6 in. long and decorated as model, can now be sold for 10s. 6d." I agree with Mr. Jacob in all he has advanced with regard to his box. The open bottom, which is movable, certainly provides ample means of drainage and means also of aëration or, as he terms it, ventilation. The construction of the window-box, as described by Mr. Jacob, is shown in Fig. 1, from which it will be seen that the front and back are nailed to the ends, and that the front, which projects beyond and over the edge of the brick-work forming the side of the window, is shaped. Fig. 2 shows a plan of the box as seen from above, and from this it will be noted that two slips, A, A, about 1 in. square, are nailed to the inner surfaces of the front and back, at a little distance above the lower edge. These ledges receive and sustain the ends of the broad laths of wood which form the bottom, and which are nailed on to two laths running transversely from end to end. The way in which the bottom is made is shown in Fig. 3. The laths need not be so far apart as shown in Fig. 3; it will be sufficient if they are about ½ in. apart and 2 in. in breadth. If the plants are grown in mould placed in the box, a layer of moss or coarse cocoa-nut fibre should be strewn over the laths.

THE EDITOR.

SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

PAPER MOUSETRAPS.—An American journal, under this heading, tells an amusing story, which may serve as a useful hint to those whose premises are overrun with mice. It is to the effect that in a house where fly-papers were extensively used on account of a plague of flies some were accidentally left on the kitchen floor one night when the family retired to bed. Next morning the mistress was delighted to find that several young mice had been caught by the fly-paper—the sticky qualities of which happened to be superior—and that, taking the hint, she set a fresh series of papers coated with birdlime, which very shortly caught all the obnoxious little rodents on the premises. The idea is not a bad one, whether the story be true or merely invented.

A REAL "BACHELOR'S BUTTON."—Several attempts have been made to provide a button capable of quick and secure attachment to clothes when needle and thread, or someone who knows how to use them, are not at hand. These qualities have been secured by devices in the market; but the button invariably fails in one important essential. The shank, being of metal, is unyielding, and the consequence is that it is most unpleasant to deal with, there being a difficulty in passing the button through the button-hole. What is wanted is a soft (preferably string) shank which can, at the same time, be securely fastened to the garment. The inventor of some simple device in this direction would earn the blessings of male humanity and, we venture to think, a substantial return for his trouble.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTER FROM A CORRESPONDENT.

Wire-work Errata.—J. S. (*London, N.*) writes:—"I am sorry that upon page 293, No. 123, Vol. III., are two errors, one palpably my own. From line 21 it should read . . . . 'wires A, B, C, D, E, F would be parallel with the free portions, M, N, O, P, Q, R; and those of G, H, I, J, K, L parallel with S, T, U, V, W, X.' On line 36, Fig. 53 should read Fig. 58."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Current for 5 c.-p. Lamp.—ELECTRO.—A 5 c.-p. Edison-Swan lamp with a voltage of 5 volts will take 3 ampères of current to light it; whilst the same candle power may be obtained from a lamp of higher resistance requiring a voltage of 65 volts, by employing a current of ·35 ampères. If accumulators are to be used, we shall require one cell for each 2 volts of lamp voltage, and one square foot of positive plate surface for each six ampères of current required. Thus, a 5 volt 5 c.-p. lamp to burn ten hours would require an accumulator battery of three cells, each cell having at least five square feet of positive plate surface. It will be better to exceed this by 20 per cent., to prevent undue exhaustion. The plates should be totally immersed in the solution, and the distance between them may be reduced to a minimum ascertainable by practice—care being taken not to short-circuit the plates. The waste will be variable, and can only be ascertained by actual measurement in each instance.—G. E. B.

Copper-Plating Solution.—X. E. A. (*Sheffield*).—Your zinc plates may be smoothly coated with copper in an alkaline copper solution worked with a three-cell half-gallon Bunsen battery, and an anode of pure sheet copper equal in area to the surface of the sheets to be coated. The alkaline copper solution is made as follows: Dissolve 2 lbs. of copper sulphate in 1 gallon of hot water. When this is cold, stir in enough liquid ammonia to first throw down a precipitate, and then dissolve this to form a beautiful blue solution. Dilute this with

1 gallon of cold rain-water. Next, dissolve 6 lbs. of 85 per cent. cyanide of potassium in 2 gallons of rain-water, and add this to the blue solution. The blue colour will all disappear, and the resulting solution will be of the colour of old ale. Pass this through a calico filter, and allow it to rest for some twelve hours before using.—G. E. B.

Carpentry.—R. K. (*Brockley, S.E.*).—Could you teach, or have you a shop you could hold classes in? Could you write effectively on any subject? I am truly sorry to know you are afflicted, though you are not specific on the subject. With the present taste for enamelling, you might make suitable articles in wood, and sell them to fancy shops; or if you can make model ships well, there is a sale for them, or fittings, which, judging by your occupation, you would be likely to understand.—B. A. B.

Arm Chair.—ERMIUS.—I must ask you to give me fuller details of the chair you allude to, as I am inclined to think that it is a patented article. You should try to ascertain whether it is patented, and send a rough sketch.—J. S.

Workshop in Garden.—PUZZLED.—You cannot erect any permanent structure in your garden, and remove it on giving up the house, without previously coming to an understanding with your landlord, and obtaining his permission to do so, which you should have in writing. See papers entitled "A Tenant's Greenhouse," in Vol. I., pp. 177, 211, and 227 of WORK, otherwise Nos. 12, 14, and 15. This will answer your queries with regard to construction, concrete floor, etc. If you are building a greenhouse you may sink the floor, if you like; but on no account sink the floor of a workshop. Let this be rather above the surface of the ground than below it.

Whitewashing.—W. A. (*Shildon*).—Sorry we could not help you in time, for we are well-disposed toward the co-operative movement and its workers, who are strong supporters of WORK, we know. There is no reason why you should not make "good whitewash," and use it properly—providing you allow for practice and experience. First put the water in the pail, then break up the whiting as you put the same into it. After standing, pour off the superfluous water; then add a little lime blue, as a faint grey dries a purer white than whiting alone. It should be quite stiff, not at all sloppy; now add about 4 lbs. of patent size, already melted but not too hot, to the pail two-thirds full with whiting, and thoroughly mix it together with your hand and arm. When cold, it will be set or jellied, and if necessary, may be thinned with a little water for use. Distemper of any kind should never be put over old, dirty stuff, but the latter washed off. A good tradesman will *not* "flap" his brush in working proper distemper; he will make very little noise, using the tip of his brush only. Whitewash or any distemper can be laid off in any direction *from* the outer or working edge. Splashes are the result of "watery" wash, not *jellied* stuff, and want of experience in working. Read the paper on "Distemper" in Vol. I.—F. P.

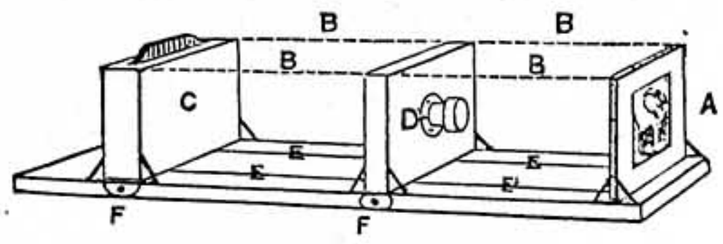
Die Sinking.—R. W. (*Bradford*).—There are good practical articles on the subject in the "Encyclopædia Britannica" and other cyclopædias. There are, as far as I know, no books published on the subject.—H. S. G.

Gassner Dry Battery.—D. O. W. (*Ipswich*).—Make the ingredients into a paste to the consistency of mortar by adding the concentrated chloride of zinc solution. A capped carbon plate with binding screw embedded in the cap, as employed in the construction of the Leclanchè cell, is employed as the negative element. Put a layer of the paste to the thickness of one inch in the zinc cylinder or cell, set the carbon plate in this, and fill all the cylinder around the carbon plate with the paste to within half an inch of the top. Seal with pitch or marine glue.—G. E. B.

Index to Vol. I.—D. O. W. (*Ipswich*).—On page 828, Vol. I., you will find the following announcement. "An Index to the First Yearly Volume of WORK has been prepared, and can be obtained by order from all booksellers, price one penny. It is included in the last monthly part of the volume (Part 12)."—G. E. B.

Bunsen Cell for Silver-Plating.—AN AMATEUR.—The Bunsen cell may be used for this purpose, but the Daniell is superior, because its electro-motive force is lower. You do not say what kind of soft metal you wish to plate, but it is, presumably, some alloy of lead such as pewter or Britannia metal. The books are right in enforcing absolute cleanliness, especially in plating on such alloys. It is best to clean the article thoroughly, rinse in a potash solution, and transfer direct from this to the plating solution without loss of time or rinsing in water. The battery must be on ready to supply current at once, and so "strike" the silver on the article before the solution has time to act on the metal. If you will follow these directions, and avoid heavy pressure with the burnisher, the silver coat should not strip whilst being burnished. You will not find a better book than that by A. Watts, so frequently mentioned in Vol. I.—G. E. B.

Enlarging Camera.—J. D. (*Hull*).—The space at our disposal in these columns is too limited to permit more than a rough outline of how to make an enlarging camera. It consists mainly of three frames, two of which are movable and slide along in grooves on the surface of a board or table about 5 ft. long. These frames are connected by a light, tight body made of black twill, which is kept extended by means of cords or elastic attached to the corners of the frames. The frame in the front—that intended to hold the transparency or negative to be copied and enlarged—is firmly attached to the base-board. The centre frame is designed to carry a small lens, as a quarter-plate portrait, or 5×4 rapid rectilinear lens. The remaining frame is made to hold the dark slide in which the sensitive plate or paper is placed. The distance between these frames regulates the size of the enlargement; the nearer the lens is to the object to be copied and



Enlarging Camera—A, Transparency; B, Elastic Cords; C, Dark Slide; D, Lens; E, Guiding Cords; F, Binding Screw.

enlarged, the larger the enlargement will be, and *vice versâ*. Provision is made for a piece of ground glass to be inserted in the exact position that will be held by the sensitive plate, and on this the image is thrown, the size adjusted, and the definition of the image properly secured. The transparency or negative to be enlarged must be equally illuminated over its whole surface, which is most easily done by aid of a reflecting screen adjusted outside, and at a proper angle. In case of artificial light a condenser is generally made use of, and the photograph to be copied placed close to it. A proper exposure being given, the dark slide is removed, and the plate or paper taken out and developed, *secundum artem;* the mode of development being dependent on the sensitive surface employed, and in no way differs from other photographic development. The means of doing this is described fully in many elementary handbooks on photography. The best way is undoubtedly to see some experienced worker do it. The principal points to be remembered in enlarging are—to let no light fall on the sensitive surface except that passing through the lens; to ascertain that the definition of the image is good; and to give the proper exposure. Above is a diagram of the whole arrangement.—D.

N. H. H. Monogram, for Inlaying.

Monogram for Inlaying.—FRETWORK.—In reply to FRETWORK, I submit design herewith of the letters "N. H. H." monogramically arranged. When cleanly pierced and carefully inlaid it should prove an elegant yet effective piece of work.—A. C.

Photographic Studio.—NEW SUBSCRIBER.—A portable studio is a somewhat indefinite description, as it may be anything from folding canvas and poles to a four-wheel van. *Any* building put together with screws unattached to any fixed foundation is termed portable. There has been no description at present given in WORK of a portable studio. The term indicates a somewhat small arrangement in comparison with the usual brick and glass building, although size has really very little to do with it. A room, say, 25 ft. long, 12 ft. high to ridge, and 10 ft. wide, will make a useful size of a ridge roof pattern. Glazed on one side of the pitch of the roof and one side to within about 4 ft. of each end—which may be opaque—it will afford sufficient facility for taking single portraits or small groups. The frame may be of wood, and the opaque portion constructed of match-boards, covered on the inside with canvas and papered. A door may be made at one end or on the unglazed side for ingress and egress. The floor should be a little above the surface of the ground for dryness' sake, and may be supported on brick or stone piers. Any builder would be able to construct one given these dimensions. If the framing is put together with nuts and screws, the studio will be portable for all intents and purposes. The height of the sides should be about 8 ft.—D.

Glass-Sign Gilding.—GILDER.—There is no electrotyping process used for glass-sign gilding and embossing. Continued *practice and experience* with the isinglass method and its accessories will alone, I believe, obtain the perfect results we see on the best glass writing and gilding, such as is turned out by the London firms, brewers' writers, etc. I cannot go here into the detail of the gilding and washing, but, assuming from your letter that these processes are familiar to you, I may help you in the subjoined. What gold do you use? Foreign beat stuff is of no earthly use for glass work, and even with the best English beat, you may not do much better if you use it from the ordinary rouged books. The rouge placed between the leaves has much to do with it, and you must get the gold put in books without it, and direct from a genuine beater or trustworthy source. There is a lot of misrepresentation going on with gold-leaf in the trade, especially, I believe, with the quality of foreign beat stuff. English E. D. (ordinary) is worth 1s. 3d. of anybody's money, so don't begrudge a few pence each book for the above kind.—F. P.

House Painting.—G. P. (*Elgin*).—In deciding how and in what style a drawing-room should be painted and papered, the matter must be looked at from many different standpoints. First, the cost: how much, roughly, we are desirous to spend on labour and material; secondly, what *aspect* the room has, whether warm or cold—a fact which materially affects, if it does not always govern, the general tone of the colour and scheme; and, thirdly, whether the decorations to be introduced are to be used with the same furniture, hangings, etc., as previously found in the room, or whether the room is to be refurnished, draped and arranged to harmonise with the new decorative treatment. When these matters of expediency are determined, then the purely decorative *ensemble* can be considered. So far as you have given me particulars, I will try to aid you. For S. or S.W. aspects, the prevailing colour—always given by the walls—may be cool tints of any silver-grey, French grey, green-grey, or even so decided as a soft "electric" blue. If the outlook from windows is all green vegetation, don't get too close to decided blue tints; if only "bricks and mortar" in front, decided but "soft" colouring in the room makes it cheerful to sit in. Rooms facing N. or N.E. and thereabouts require warm tints to compensate for the small amount of sunshine and warmth they get. For such, old gold tones, and verging to cinnamon and rich brown, may be best, and from these on to the endless varieties of terra-cotta tints as far as deep crimson. The latter in plain flock paper is excellent for engraving background; whilst in silks it is very popular for walls of State and aristocratic drawing-rooms. With *grey and blue walls*, cream or "ivory white" paint, and panels of door in grey tone with walls is best, ornament on panels "old gold" or grey monochrome, and gilding to mouldings; ceiling cream, grey band of about 9 in. on same next to cornice, ornamental corners and lines of old gold separating the cream and blue. Cornice with cove, or recessed parts, grey, remainder cream, same as the ceiling, with a little "lakey" pink in shadowed parts. For the cornice, painting and flatting is best, but distemper quicker and cheapest. A little gilding on the beads of cornice makes a wonderful improvement; this cannot be done on distemper without other preparation. In your case, have a border about 5 in. deep to match colour of walls, but more enriched, fixed under the cornice, and use a set dado-pattern beneath existing rail, fixing the dado border over the latter. Walnut will suit with blue or golden-brown tones if not too bright. The cover won't hurt, but the modern style is quite opposed to large centre table and set *suites* of chairs, etc. Paint the mantelpiece with the woodwork, and if it is bare and ugly, structurally, you must decorate it a little or drape it, the former if the fireplace is used much. "Workshop Receipts" are published by Messrs. Spon, Charing Cross, London, in four series, at 5s., treating different crafts and sciences. Make sure of the one you want before ordering the volume. Thanks for your letter; most of it has been now answered in other ways. I have, in reply to you, given more than I ought, in order to show any future inquirers that decorative advice cannot be given unless *all* details of the work are sent by the querist, as pointed out.—F. P.

Loose Pulleys for Circular Saw.—S. B. (*Nottingham*).—You cannot do better than follow the advice of Mr. Powis Bale on loose pulleys. Certainly he is right in saying that they "should in all cases be bored and rhymered perfectly true." He clearly means that when the pulley rides upon a bush or sleeve, that the bush is to be *fixed* upon the shaft, and the pulley is to revolve on the sleeve (or bush, as you term it). Probably the term *bush* implies a lining to the hole in the pulley, which, I think, would not improve it. Mr. Powis Bale means a covering to the spindle, for he says, in explaining the action of the oil, that motion "causes the oil to

fly immediately to the largest diameter, which is the working or rubbing face of the sleeve." He does not say how the sleeve is to be fixed to the shaft, but no doubt a screw countersunk would do, or perhaps two might be needed. The best plan would be to turn the outside of the sleeve *after* it is fixed on the shaft, and see that the ends are also turned true, and the pulley boss true also on the face, so that when the flanges are fixed they retain the oil, as Mr. Bale says, and keep the pulley in place as well. If any difference in size is made for the purpose of relieving the strain of the belt, I should, by all means, "make the loose pulley with an inclined flange leading up to the fast pulley," and let the difference be small.—B. A. B.

Polishing Bullocks' Horns. — ANXIOUS. — ANXIOUS writes to know what acid is used with whiting to finish these with. I expect the acid he saw used was sulphuric acid very much diluted, —say, 1 part acid to 40 parts water; but vinegar answers almost as well. To use whiting and weak acid in polishing horn is of no use unless the horn has been prepared for this final polish by being got smooth by glass or glass-paper or steel scrapers, followed by powdered pumice or powdered Bath brick, this being followed by a still finer polishing powder—viz., rottenstone, which can be mixed with oil. These powders are applied to the work by means of a piece of cloth or felt. The work should be well washed after each stage, so as to remove the coarser polishing powder before applying a finer one. The whiting and acid is used after rottenstone; finally, a portion of dry whiting gives a finishing polish to it, and is best applied by the palm of the hand. One man tells me that a mixture of soapsuds and whiting produces a good surface when it is applied after rottenstone. Plenty of rubbing is necessary in all of the stages.—H. S. G.

Stopper Bottles for Drugs. — J. M. R. (*Stratford*).—I believe that chemists usually get their stopper bottles with their drugs from the manufacturing or wholesale druggist. J. M. R. could, doubtless, get his, ready filled with the chemicals he wants, from such a firm as Baron, Harvey & Co., Giltspur Street, London, E.C. Yet, as he asks for the address of a manufacturer, I may mention the York Glass Co., York, who make a special feature of these bottles.—S. W.

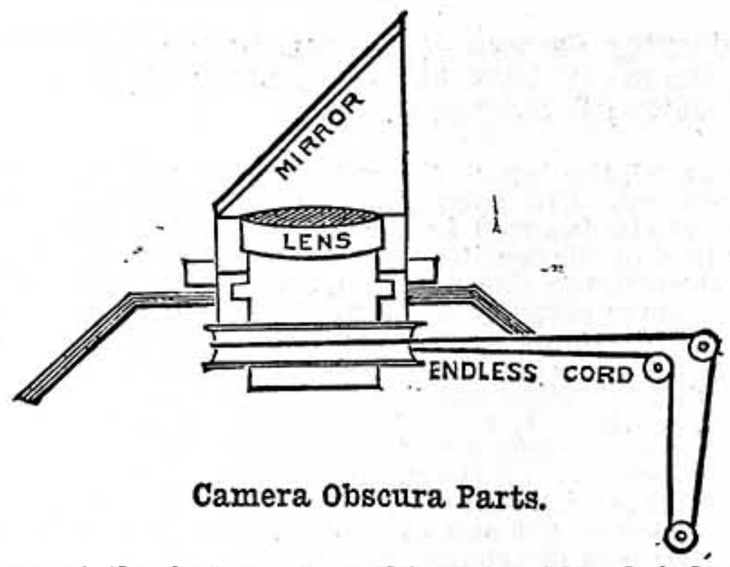
Tricycle Mechanics.—R. S. (*Airdrie*).—I have not heard of a tricycle to draw by electricity or air being lately brought out in America. Both steam and electric tricycles have been tried in this country with some measure of success. For common use, no power other than the feet has yet been successfully introduced; steam, I believe, will never be a success. Compound air requires strong heavy vessels to contain it, and the machine would be necessarily heavy. Electric motorology, so to speak, is yet in its infancy, and no one can imagine what it is capable of accomplishing, if men only knew how to construct an apparatus to utilise it to its full extent. As to its application to tricycles, I have no doubt it will yet be largely employed. Meantime, I would advise your correspondent to provide himself with a good tricycle, and have for a motive power his own pedal extremities.—A. S. P.

Simplex Dynamo. — F. D. (*Liswalt, N.B.*). — I cannot quite understand how you have wound the armature of your dynamo. You say you have "wound the wire *all on the outside* of the ring." I suppose, therefore, that you have treated the ring as a drum, and wound the wire over it. Have you divided the ninety yards of wire into three sections and provided a six-part commutator for the ends? If so, are you sure you have made the connections right? If you have not done so the machine will not give any current. Supposing you have wound the wire on all right and connected the coils properly, I do not think you have gained anything by winding such a thin ring as a drum with the wire all on the outside. You have now only thirty-five yards of active and fifty-five yards of dead wire on the armature. I cannot say what you may expect from your machine—probably a current of 3 ampères at a pressure of thirty-five volts when driven at a speed of 1,300 revolutions per minute. Possibly you may get enough to light three 8 c.-p. lamps. — G. E. B.

Discs for Electric Belt.—L. W. (*Islington*).—I should advise you to get some thin sheet copper and thin sheet zinc, and cut out some discs the size of half-crown pieces. Coat these with thin flannel and sew them to the belt. I cannot tell you where they may be purchased. If you find any difficulty in getting them, write to my brother at 19, Avenue Road, Lewisham, S E., and ask him to make some for you. He offers to get any electrical appliances for amateurs.—G. E. B.

Nickel-Plating.—FEODO.—You will find the job of nickel-plating a tricycle a most expensive one, as the necessary vats for such large work will cost a lot of money to purchase. Far better get it done by a professional plater. I hope to describe the whole process of nickel-plating in an article on the subject, but have not space at my command for this in "Shop," and a short paragraph on this art will be useless to you. In reply to your questions, I may say that nickel may be deposited from a double sulphate of nickel and ammonia solution direct on to the iron or steel without having to first copper the parts. But they must be first freed from organic impurities contracted in polishing, by boiling them in a solution of caustic potash, then rinsed in a solution of caustic potash, then rinsed in a solution of cyanide of potassium, and transferred at once to the nickel-plating solution before they have time to get rusted. A Bunsen battery of large cells will be needed for large articles.—G. E. B.

Camera Obscura. — NEW FANCY. — Make a sufficient number of frames. Cover them with Willesden canvas on the outside, and black lining on the inside; they might be hinged together in pairs. The height should be about 8 ft., and when set up, bolted firmly together. One side should be left open, and overlap thick curtains hung across as a means of ingress and egress. It need not be said the place must be perfectly darkened when in use. The roof must be made, and frames covered in the same manner as the sides, with an aperture left in the top for the lens. The mirror should be about a foot square, placed at an angle of 45° with regard to the lens, and made to revolve by a cord and pulley, after the manner of an ordinary blind. The kind of lens best adapted is a good single achromatic landscape lens, of the proper length of focus



Camera Obscura Parts.

to cast the image on a whitened table placed at a comfortable height for inspection. There is no necessity to have the table concave; a flat surface will answer every purpose if the lens is a good one. An excellent surface is made by pouring a mixture of plaster of Paris in water just thin enough to pour on to a flat table to about three-quarters of an inch, and let it set properly levelled. A rub with fine glass-paper will at any time renew the surface, and keep it in good condition for inspection. The accompanying diagram will show how the mirror is revolved. The mirror is mounted in a box which revolves, carrying the mirror with it. The sides are filled in with wood blackened, only the front facing the mirror left open, which may be closed when not in use by a shutter. It is as well to arrange it so that the lens can be removed for polishing when required. The whole thing is exceedingly simple. The size of the room is immaterial, so long as there is sufficient space to move comfortably round the table. The whole may be secured with guy-ropes like an ordinary tent, as the positions generally chosen for setting them up are elevated and exposed, and ropes offer the best security. If the building is of boards, the uprights will, of course, be sunk in the ground, and require no further precautions.—D.

Electric Time Alarum.—N. H. Y. (*Battersea*).—Thanks for your letter describing your electric alarum. It does not present any new features of improvement on those already described. A short time since I saw a much more simple method of using an ordinary alarum. The workman connected one wire to a piece of thick brass, and laid it down on the bottom of his clock. He then connected the other wire to another thick piece of sheet brass, and set this with one end resting against the hammer of the bell alarum. When the alarum went off, this piece of brass fell down to the bottom of the clock, and closed the circuit of an electric bell placed near the head of his bed. Thus he had the benefit of two alarums, and did not remove the bell as you have done. Placing the battery in a cupboard by the fireplace is bad for the battery. It should be kept in a cool and slightly damp place. —G. E. B.

Winding Dynamo.—H. E. A. (*Hackney*).—The field magnets of your dynamo are of the Siemens type. On such a small machine, having an armature 3 in. long by 1½ in. in diameter, you will only be able to get 4 oz. of wire, even if it is silk-covered. The utmost current you will get from such a small quantity of wire, without injuriously heating the coils, will be 1 ampère. The smallest wire that will safely carry this current will be No. 22 B.W.G. Four ounces of No. 22 wire will measure 30 yards, and we shall have to reckon one-third of this as dead and useless, because it will work out of the magnetic field on the armature ends. This will give 20 yards of active wire on the armature, and will develop an E.M.F. of 20 volts when driven at a speed of 1,200 feet per minute. To balance this, you will require 1½ lbs. of cotton-covered No. 22 wire in the fields, connected in shunt with the armature coil. Use single cotton-covered wire, well soaked in hot paraffin wax. As an insulating covering for the iron, employ tough brown paper soaked in hot paraffin. Cut strips from this, and soak in hot water to soften them. Dress the iron with hot, thin glue, then mould the softened and prepared paper to the shape of the iron. Allow this to dry and get firm before winding on the wire. You will only need one layer of this if you are careful, in winding the wire, not to cut through the layer. The finished machine will look well if painted with Aspinall's enamel. You may make up a paint for the purpose by mixing Venetian red with methylated spirits, and then stirring in enough white hard varnish to bring the paint to the required consistency. If you get Bottone's book on "The Dynamo: How Made and Used" (latest edition), you will find a whole chapter devoted to winding dynamo machines.—G. E. B.

To make Cotton Waterproof.—G. D. (*Woolwich*).—To do this without making it sticky, it must be dried at about 150° Fahr. by artificial heat. The sun on a hot day will do. Get as much boiled oil as is necessary, and mix enough lamp-black to blacken it, if for black work; if for yellow, use ground yellow ochre instead. Then lay the fabric on a smooth surface, and put the oil on with a brush—a shoe brush is best. Let the first coat get quite dry before putting on another. A little patent driers will make it dry quicker—say, ½ lb. to a gallon of oil. If the last coat remains sticky after it is dry, take 1 lb. of shellac to 2 quarts of water, simmer it gently, and when near boiling add a little liquid ammonia to dissolve the shellac: when this is cold mix a little lamp-black for black; if yellow, use it as it is. If the fabric is coated over with this, it will make it hard: put it on with a sponge. Lay the oil on as thin as possible, or it will not dry. Of course, this paint will, in a measure, obstruct the light.—L. Y.

Tarpaulin.—CARDIFF No. 1.—The reply to the query sent is given in WORK, No. 118, p. 222, Vol. III., in answer to the inquiry of an earlier correspondent.

Bookcase.—J. P. (*Blackburn*).—The Editor has a paper in hand on the construction of a bookcase. It will appear as soon as practicable, and will, no doubt, help you, though it is intended to be made to stand on the floor, and not on a shelf. By the way, your inquiry about a bookcase of *ordinary* size is very vague, and conveys little or no meaning. Do you not think it would have been nearly as easy for you to have given an idea in feet and inches?—D. D.

Elastic Mould.—CICERO.—The following recipe has been recommended:—Gelatine 1 lb., beeswax ½ oz., to which add three-quarters of a pint of water. Boil in a glue-pot to a thick syrup, and pour it over the work to be moulded whilst warm, but not boiling. None but the best and purest sheet gelatine ought to be used.—M. M.

Removal of Hair by Electrolysis.—J. S. (*Preston*).—For the removal of hair by electrolysis you will require a bichromate or chromic acid battery of several small cells, and a switch to throw a variable number of cells in the circuit at will. You will also require a pair of platinum or gold needles with suitable handles, costing about 6s. per pair. The needles are inserted in the skin at the roots of the hair, and a current of electricity is passed until the root-glands are destroyed by electrolysis. It may be necessary to employ a large number of cells, some ten or more in series. I do not advise you to perform this operation yourself, as it would be more costly and uncertain in results than when performed by a qualified practitioner. The battery and needles may be obtained from Mr. K. Schall, 55, Wigmore Street, London, W., or Messrs. T. Gent & Co., Braunstone Gate, Leicester. —G. E. B.

Electric Bells. — NEW READER. — The book, "Electric Bells: and All about Them," was written by Mr. S. Bottone, Wallington, Surrey, and is published by Messrs. Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C. The price is 3s., and it can be obtained direct from the author or publishers at this price by post. Questions cannot be answered in "the next issue" of WORK. —G. E. B.

Angle Cog Wheels. — C. H. (*Finsbury*). — I should advise you to write to Messrs. Ormerod, Grierson & Co. (Limited), St. George's Ironworks, Manchester.—F. C.

Distemper Colours. — B. A. (*No Address*).—"Recipes for mixing the most fashionable distemper colours for walls for a public institution." This request, simple and plain although it may appear, is really very indefinite. A chapel, a theatre, and a free library would each and all, I presume, come under such a category; but how different are the sentiments associated with each! I, therefore, cannot help you with instructions particular to your special apartment or hall. A few considerations, however, of the subject generally will probably aid you and many other readers of WORK, with whom the handling of mass colours and tints is a most obtuse and difficult problem. The relationship of fashion to colours, rational as it *may* be in connection with bonnets and dresses—*irrational* it most often is—when looked at from any common-sense standpoint, can be but of a suppositionary nature in the practical colour-decoration of apartments. Therefore, we will substitute "useful" for "fashionable," and come to some conclusions. Distemper, or any absorbent *tempera* paint, is certainly preferable to oil paint for public buildings. The former holds the condensed moisture, and then dries out again; whilst with the latter, the moisture gathers on its surface and trickles down the walls. The range of colour suitable for such places is rather limited, unless the scheme of decoration is elaborate, and the colours properly balanced and juxtaposed. In dealing with *masses* of plain tints, mixtures of *pure* pigments, such as red, blue, or green, with *white alone*, are seldom successful. The larger the mass presented to the eye, the less must be the strength of *colour*. Now, every positive

colour effect conveys a definite sensation; whether we can analyse it or not, such is the case, unless the beholder is colour blind to more or less extent. The sensation of red is chiefly warmth; of blue, coolness; of yellow, brilliancy and excitement; and, lastly, of green, a cool and soothing effect upon the mind, usually, as well as in scientific reality to the colour-nerves of the human vision. Without going further into theory here, you can now apply the above to your own purpose. Turn to the new tint circular of the Alabastine Company. Do you want a warm-looking room, use No. 6 or No. 18; or if extreme warm richness is wanted, dull tones of No. 24. For cool, well-lighted halls, etc., No. 16 is very soft and suitable, and lights up admirably. Nos. 9 or 23 are also good, but rather too bright if the light is strong. No. 1 is a good serviceable tint, cool and clean, and would not clash with any accidental colour (dresses, etc.) that might be introduced, as in a ballroom. Amber and cinnamon colours are very popular for theatres, contrasted by a little of such as No. 9, but they require clever handling, and are best only used for places lighted by yellow gaslight. Recipes, used in the sense of exact written parts and proportions, cannot be given for *colour* mixing. Experience for ordinary purposes, and added thereto a natural and cultivated faculty for extraordinary instances, can alone be the guide to success. If you haven't got the colour card alluded to, write to the Company at 127, Pomeroy Street, London, S.E. A bed-sitting room would look well in No. 6, with a soft terra-cotta brown (*not purple*-brown, please!) dado for a northern aspect. For a sunny room, either No. 1, 8, 9, or 16, with a dado of 10, 19, 18, or such like, of dull, yellow-brown tones. A stencil border, and, perhaps, frieze stencil of a *darker* tone of dado colour used upon the filling colour, would make a very pleasing finish.—LONDON DECORATOR.

Medical Coil.—W. A. S. H. E. (*Sheffield*).—The ordinary Leclanchè cells as used for bells will serve very well indeed for a medical battery, or to form a battery for working a medical coil. They are quite equal in power and efficiency to the special forms of this battery. A special price is charged for the special forms, because special attention is paid to sealing the cells, adapting their form to the box in which the battery is held, and making it portable. Where special portability is desired, I should recommend a battery of dry cells, such as the Gassner, Gent's "Perfect Dry Cell," or the "W. & R" cells, obtainable from Messrs. Gent & Co. Faraday Works, Leicester; or Mr. K. Schall, 55, Wigmore Street, London, W. I do not know the "Harness" cells, so cannot say whether they will work a medical coil successfully or not.—G. E. B.

Colourless Varnish.—A. M. (*Liverpool*).—I have a practical acquaintance with both gilding and photography, and yet know nothing of "a colourless varnish used after gilding picture-frames, and which same varnish photographers use for finishing." *Finishing* what? Gilders use, or should use, a final coating of clear parchment size—made from parchment trimmings and water simmered for many hours in a clean saucepan—upon all gold-leaf gilding. Photographers use—or should use; the amateur doesn't always—a coating of a spirit *negative varnish* for finishing his negatives. Cheap frames are "gilded" with white metal, and then coated with a yellow spirit lacquer. For cleaning oil paintings of value and without risk, get Brodie & Middleton's (Long Acre, London) "Anadeiktine," sample bottle, 1s., with instructions. Several good recipes for gold lacquers for brass-work are given in Vol. II. (see Index). I cannot help you more without the exact particulars of your work and wants. A colourless varnish, useful for gold, bronzes, etc., is a solution of white stick lac in methylated spirit.—F. P.

Whole-Plate Camera.—F. W. B. (*Leicester*).—If you will refer back to the first volume of WORK, you will see a full and explicit description of how to make a camera whole-plate size. It is very easy to alter the dimensions to 6½ in. by 4¾ in.—the size you require. Of course, rather lighter woodwork may be used, and when panelling is directed, merely clamping will give sufficient strength. Keeping to the general design, many little alterations will suggest themselves to the maker to reduce the labour, and yet afford sufficient rigidity. As to cost, much depends as to the market you go for the raw material; ten or fifteen shillings would probably procure it.—D.

Self-Acting Fountain.—W. C. (*No Address*).—An article describing the construction of a self-acting fountain appeared in No. 69 of WORK. From the diagram therein, illustrating the working of the apparatus, you should be able to make such alteration as would suit your purpose in fitting it to an aquarium. The latter is a somewhat difficult job, and I do not recommend a self-acting fountain for the purpose; the oxide from the zinc kills the gold fish, and the dirt, etc., inseparable from a flourishing aquarium, is continually stopping up the jet-hole. It is far better to connect to a water supply and run off to waste.—C. M. W.

Tray for Coins.—R. E. D. (*Holborn Circus*).—Your most ready way will be to cut a piece of millboard to fit your wooden tray, and to pierce the holes through this; no levelling of the bottoms of holes will then be required. The millboard can be fixed down to the wood with four, six, or more brass tacks, as size may require. A great advantage of this plan is that, when the acquisition of more coins renders (as it is sure to do) a rearrangement of the collection imperative, the millboard can easily be detached, and a new one cut and fitted in. The holes are most readily cut with gouges of suitable sizes, but in the absence of such tools a sharp penknife will answer the purpose.—M. M.

Sign Writing—the Lemon Tree.—GUGLIELMUS.—As I remember (I have lived in a lemon growing country), there is no appreciable difference in foliage between this and the orange tree, but the lemon is less bushy in growth; the fruit, of course, is widely different in form and colour. The annexed sketches, though drawn from memory, will, I trust, be sufficiently accurate for any but scientific purposes. Fig. 2 shows the growth, Fig. 1 is the tree conventionalised to fill the required space. For the purpose in view, GUGLIELMUS is advised to make his fruit big enough, and to give to trunk, fruit, and leaf, a bold black outline. The fruit, to make an effective

Fig. 1.—Sign of the Lemon Tree.

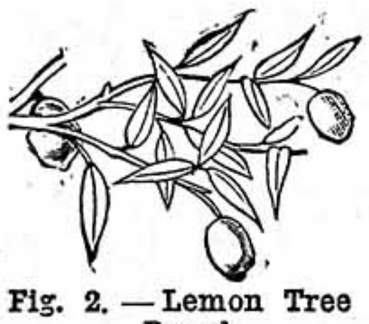
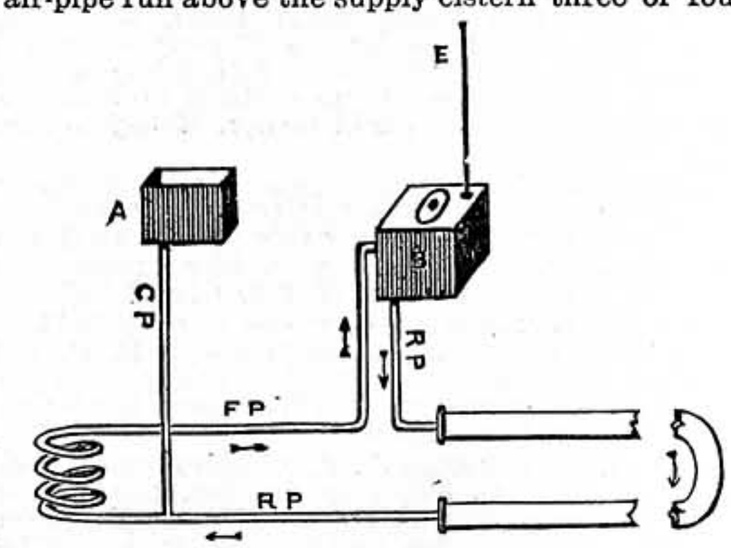


Fig. 2.—Lemon Tree Bough.

sign, should be gilded, and can be shaded up with wash-black mixed with just a dash of verdigris and Prussian blue. The leaves should be of a dark green, something like that of the laurel. GUGLIELMUS will see that the Moorish arch, as sketched, will compare better—will be better filled by the tree—than the Roman one which he suggests. It will also be more appropriate, as being the arch of the countries where lemon trees grow.—S. W.

Failure in Coil.—J. L. (*Upton*).—The cause of your coil not circulating properly is because the coil is not low enough. You should have arranged it so that your *lowest* pipe—technically known as the "return"—was slightly above the top of the coil or boiler. As you have got it all fixed, it would be, no doubt, awkward to lower the coil, but you will have to do it or adopt the following plan, which you will find will make it work satisfactorily. Procure a small cistern, which must have a man-hole cover, and also an air-pipe out of the top; fix the cistern a foot or two above your pipes (see sketch), and let the air-pipe run above the supply cistern three or four



Failure in Coil—Cold-Water Supply Cistern; B, Hot-Water Cistern; C P, Cold Supply-Pipe; F P, Flow-Pipe to Cistern from Coil; R P, Return Pipe to Coil; E, Air-Pipe. The Arrows show the Circulation.

feet. Next cut your flow-pipe (top pipe of the coil), and run a pipe from the coil up to the cistern; take it in at the side with an elbow, nipple, and back-nut, then run a pipe from the cistern, and connect to your cast-iron pipes, or to the wrought pipes where cut; this you will see is making the cast pipes wholly a return to the boiler or coil, and you will find it act perfectly. Of course, you have your cold supply taken into the lowest pipe of the coil. I shall be glad to hear how you get on with it, and to help you further if you find any difficulty, but do not think you will.—R. A.

Preserving Skins of Moles, etc.—W. F. (*Salisbury Square*),—The dampness of the skins in wet weather of which you complain is probably owing to the use of salt in preserving. The dressings recommended in curing skins are legion, and common salt, bay salt, and saltpetre enter into the composition of many of them. Alum alone will, however, suffice, though the addition of a little corrosive sublimate will render the skin safer from insects. One way is to dissolve the alum, etc., in water, and rub the solution into the skin (on the flesh side) daily for a week or two. Of course, all flesh, fat, etc., should first be scraped off, and it is well to stretch and tack the skin, fur downwards, on a board. Some, however, prefer to use the dressing dry, and instead of stretching to lay two skins flesh sides together after dressing, to roll them tightly up, and tie them. Skins may afterwards be made soft by rubbing over a metal edge.—S. W.

Dulcimer.—H. B. (*Wakefield*).—The stringing of the dulcimer is a very simple matter. The lowest note is composed of four brass strings, the next of four steel, the next of four brass, and so on, alternately, to the top of the instrument. If you have been trying to pull the brass strings up to the same pitch as the steel ones it would account for the breakages; but if the instrument has been properly strung, then the fault lies in the wire, as good wire ought to and will go up two or three notes above the pitch at which it will be required to stand. Are you sure you have obtained the right sizes? The dimensions you give of your instrument are out of proportion; one of twenty inches in length on the sound-board would require to be at least fourteen inches deep.—R. F.

Polishing Ebony Walking Stick.—E. W. (*Islington, N.*).—Being made of ebony, which is of a very close grain, no "filling" need be used. To polish it, you will require a little white or transparent polish, which is applied with a polish rubber. For particulars of how to make, see No. 108 of WORK, issue of April 11th; and "How to French Polish" in No. 105, March 21st. If the ebony is not perfectly black, you will require a little gas-black or Frankfort black on the face of the rubber; at least, this is the way most polishers would do it. But as you appear to have no knowledge of French polishing, and may have to buy your polish ready made—which I strongly advise—you might do worse than send to Mr. Flack, Steam Works, 75, Blackman Street, London, S.E., for a small quantity of "Ebonite" French polish and spirit varnish; or to Thos. Jackson & Son, 199, Borough High Street, London, S.E., for their "Improved Ebony Polish." No previous staining is required for these, and I believe full particulars of how to apply are given with each bottle. The handle can be fixed on with a little of Prout's bicycle cement, or a little ordinary shellac will do, applied with a hot iron in the same way as the cement.—LIFEBOAT.

Window-Sash Making.—I. H. (*Holloway*).—I know of no book specially devoted to sash making. You will find a great deal of information has been given from time to time in WORK, in pp. 177, 211, 364, of Vol. I., and in pp. 192 and 405 of Vol. II. If after reading these you are still in a fix, I shall be pleased to give you any information you may require on receipt of detailed descriptions of what you find any way puzzling, which descriptions you will be very much more able to give after thoroughly digesting the various tips contained in the above numbers of WORK.—E. D.

Supply of WORK.—R. H. (*Notting Hill, W.*).—If you or any other reader should experience a difficulty in getting WORK, whether in current or back numbers, you should apply to the publishers, Messrs. Cassell & Co., Limited, Ludgate Hill, London, E.C., and it might be well to quote the name and address of your bookseller.

Lettering.—W. P. (*Southampton*).—The letters are done with gold-leaf on an ordinary black ground, and then varnished.—T. W.

Polish Reviver.—J. P. (*St. Helens*).—Read carefully replies already given in "Shop" during the last few weeks—"Polish Reviver," p. 238; "Cracked and Dull Polish" and "Polish Reviver," p. 315. These fully answer your question.—LIFEBOAT.

Bent Shafts.—T. S. (*Pendleton*).—I cannot advise you to try and bend your shafts for your proposed mail cart, as the process would be too tedious. We have several times bent shafts for light traps: but the cost in time and trouble, to say nothing of the expense of a shaft occasionally snapping in two pieces, far exceeded the price of what we could have bought new bent shafts for. I should advise you to get two shafts sawn out of straight-grained ash free from knots, 1½ in. square when planed up, and 53 in. long. I see from your address that you live near Manchester; therefore I advise you to take your straight shafts to be bent at Thurman's, bent timber merchant, Hulme Street, off Oxford Street, Manchester, where they will soon bend according to any shape you like—indeed, I am not sure but what you can buy them ready bent. However, I would, if I were you, pay them a visit to ascertain before going on any further. When you have got the shafts bent, you just simply round the handles off, and take the average off the sharp edge of the shafts.—W. P.

Tram-Line Curves.—J. G. B. (*Oldham*).—The gauge or width between the rails is 4 ft. 8½ in. on most lines, though there are some narrow gauges in use. To get the curve for any particular turning, you must have a plan of the streets, and mark down the largest radius you can get in. This, however, will not affect your invention I take to refer to operating the points. There is no difficulty in the matter. If you send a sketch, I shall be happy to give you an opinion and advice upon it.—F. C.

Shock Coils and Time Alarum.—J. K. (*Manchester*).—I share in your pleasure, because you have been good enough to give me an account of your success in making the electric time alarum. It gives me pleasure to know that you—only a youth of fifteen years—have succeeded in making an excellent time alarum at a cost of 5s. The delay in answering your former question was unavoidable, owing to the crowded condition of our "Shop." If we devoted the whole of our little pennyworth to the publication of contributions to "Shop," it would take several weeks to catch up with arrears of replies to correspondents. I cannot promise a date for the publication of the articles on shocking coils. You will find Dyer's work on coils a fairly good one for a beginner. Coil making is quite within the province of an amateur.—G. E. B.

Silvering Carriage Fittings.—COACH TRIMMER (*Edinburgh*).—Carriage fittings are coated with silver by the electro process. This will be described in due time, when room can be found for the articles. There are no addresses of coach-makers' furnishers in the London Directory; but coach furniture is made and supplied by Mr. C. Bunn, Herbert Street, West Bromwich, and Messrs. J. H. Hawkins & Co., 16, Station Road, Walsall. Of coach platers there are twenty mentioned in the directory, amongst which may be noticed Messrs. J. H. Radcliffe & Co., 8, Barrett Street, Manchester Square, London, W., and Messrs. Smith Brothers, 53, Paul Street, Finsbury, E.C.—G. E. B.

Imitation Marble.—E. M. H. (*Glasgow*).—The reply on p. 112, No. 59, to similar query will suit your freestone stand equally well, taken in conjunction with the following: As the surface of stone will not be so smooth and regular as wood, I would advise you to rub up a stiff paste from warm patent size and finest whiting. After the first coat of paint is thoroughly hard, scrape on or brush on, according to convenience of surface, a good coating of this "filling up." When same is quite dry, rub it down to a smooth and level surface with fine glass-paper. A coat of linseed oil, with a little patent driers only added, is next given; this hardens the surface. When dry, proceed with the painting as described on p. 112.—F. P.

Picture-Frame Gilding.—S. S. S. (*New Kent Road*).—The writer, who humbly but firmly claims to be a "real practical man," might have practically helped you had you stated the *nature* and *condition* of the frames to be gilded. I must refer you to pp. 603 and 795, Vol. I., as answers therein appear worth your careful perusal. If you mean how frames *water-gilded*—viz., in mat and burnish size—are properly re-gilded *same* way, it is a matter beyond "Shop" entirely. The labour necessary to thoroughly "re-get-up" a water-gilt frame is so excessive as to make it seldom done, and they are usually re-gilded with *oil-gold* size. Although the process may eventually be thoroughly explored in WORK, few would benefit therefrom. If you want to learn it thoroughly from a professed "carver and gilder," advertise for lessons.—F. P.

Varnish.—G. H. (*Wakefield*).—Oil varnish, if at all exposed to the air, will thicken and become "fat," owing to the mixture taking up oxygen; the cheap qualities, by reason of the copal gum being substituted by common resins, become so affected much quicker than good "copal." They can never regain their original qualities by any dilution or addition, but may sometimes be so thinned with turpentine as to be useful on common work. The "turps" re-dissolves the oil and resin, but, of course, reduces the bulk and gloss. Mathieson Brothers, of Ardrossan, N.B., make an "enamel oil" which can be advantageously mixed with varnish. To add ordinary linseed oil means that the varnish will never properly dry.—F. P.

Paper-Hanging.—C. H. (*London, S.E.*).—It seems somewhat difficult to describe any method of "folding a pasted length of paper in order to convey it from the board to the wall" as being "the *correct* one," since individual experience and expertness is the only standard of judgment we have. One of the best that a professional worker will use for lengths of about 8 ft. I will endeavour to explain. The lengths being cut to about the right size and properly arranged for clean pasting upon the paste-board, the lower half is first pasted, and then folded over for about 18 in. or more of doubled length. The paper is moved along and pasted complete; the upper half is then folded over for a distance, and then the top edge turned right back. In conveying and fixing it, the top edge is taken hold of firmly but carefully by finger and thumb of each hand, and the fold is held by the other fingers. Assuming a practised and smart man is working, he will then mount the steps in a convenient position without holding with his hands, but using them both for the paper. The worker being in position, he drops the top fold, which has been held by his fingers, and fixes the upper half in place. If correct in plumb, this is rolled or brushed; and then, descending to the ground, the bottom end is unfolded, and the length brushed down, trimmed, and completed. If the man is working from a plank and scaffold, he must, of course, use one hand to get up to his work, in which case the top is folded as the bottom, and the length thrown over one arm. The difference between having the top edge in the fingers ready for matching and that of having to unfold the same, makes a great difference in the speed of paper-hanging. I hope this is the answer you wish for, and that I have made myself clear. If you use this method I don't think you can better it.—F. P.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Opal Glass-Letter Cutting.—OUVRIER writes:—"I should be glad to have the address of makers of the appliances for cutting out glass letters, and any information respecting the method of making same."

Heliograph.—R. N. (*Grays*) writes:—"Can any of your readers describe how to make a heliograph, and also the mode of signalling with it?"

White Letters on Glass.—GLAZIER writes:—"Can anyone tell me how to remove the same without breaking?"

Pumps.—J. H. (*No Address*) writes:—"Will any reader kindly inform me where I can get a book about pumps, engines, and such like matters? I want something with drawings, so that I can see the inside steam passages."

Refrigerator.—J. H. (*Liverpool*) writes:—"I have a refrigerator to make. Would any reader give me a plan of one fit for a butcher's shop?"

Bones.—E. F. P. (*Warrington*) wishes to know if any reader can tell him of any book or books on "Bones," or the uses, etc., to which bones are put.

Rubber Arrow Shooter.—ARROW SHOOTER will be obliged to any reader who will tell him how to make a rubber arrow shooter.

Hat Making.—J. S. G. (*Portsea*) writes:—"Can any correspondent give me a little assistance in hatting? Being a hatter's salesman, I should like to know the process of half-blocking a silk hat; also, whether there is any way of taking grease or other marks out of hats other than washing the hat, for I find it takes such a long time to dry a hat when washed; and I often have a customer that wants his hat cleaned and ironed whilst waiting."

Terra-Cotta Plaques.—PLAQUE ARTIST writes: "Where can I purchase, good and reasonably, terra-cotta plaques of various sizes—not a large quantity, but a few dozen or so at a time."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Root's Blower or Blast Fan.—M. (*Bishop Auckland*) writes, in reply to F. W. B. (*Huddersfield*) (see page 286, No. 122):—"Try A. Walton, 9, Queen Anne Street, Stoke-on-Trent, for castings of small blast fan."

Saw.—CHOPSTICK writes, in reply to CONSTANT READER (see No. 120, page 251):—"The sketch and information you ask for would take up too much space in 'Shop' columns. I will, therefore, send a brief article on the subject shortly, which will give you full information; but I can tell you this now: you must not expect to cut 3 in. stuff without some hard work with only one man on the wheel—it is best to have two when there is any quantity to do."

Upholstery.—E. W. C. (*Leicester*) writes, in reply to T. C. (*Belfast*) (see page 286, No. 122):—"Your question is unintelligible. Do you mean an outside cover to cover the whole of the article of furniture, or do you mean hair seating, otherwise known as hair cloth? Also, what do you intend to cover, either scroll, back, or seat, and is it a sofa or couch? The former has a scroll at both ends, and the back extends between the two; the latter has only one scroll, and the back only extends about three-quarters of the seat. If you will state definitely what you intend to cover, also with what material, I will try to help you."

Worm and Wheel.—E. G. PLATT, Birbeck Works, Birbeck Road, Ridley Road, Kingsland, N.E., writes:—"I see by one of your answers in 'Shop' (see page 269, No. 121) that you cannot give your correspondent an address of rack and wheel, or worm and wheel maker. I beg to offer myself as same."

Battery.—THE ELECTRICAL COMPANY (*Crewkerne*) write, in answer to T. R. (*Ashton-le-Willows*) (see page 270, Vol. III.):—"Our new central zinc batteries would answer the purpose required. The prices are—No. 1, 1s. 9d.; No. 2, 2s.; No. 3, 3s."

Air Cushion.—H. H. P. writes, in reply to H. R. (*Clapham*) (see page 222, No. 118):—"If H. R. will fill the cushion with air, then put it in a tub of water and press it, he will find where the leak is by the bubbles that arise."

Bread Machines.—W. A. (*Faversham*) writes, in reply to JEAN (see page 286, No. 122):—"You could not do better than apply to Mr. W. F. Mason, engineer and patentee, Longsight, Manchester, for prices and particulars. His machines are simple in construction, and make a good, even, and smooth dough. They are also fitted with friction gear for throwing dough out, which I must say saves a lot of winding tank up and down, as in most machines. The bakehouse where I am has been fitted up by Mr. W. F. Mason, and I cannot speak too highly of the way I find things to hand, which is a great pleasure in the trade."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—G. H. (*St. Helens*); C. S. (*Leigh*); E. G. (*No Address*); T. B. D. (*Glasgow*); W. H. C. (*Leicester*); F. W. (*Kentish Town*); F. H. (*Battersea*); P. McN. (*Shettleston*); R. A. B. & Co. (*London, W.*); B. A. C. (*Glasgow*); L. & Co.; F. M. (*Portsea*); W. C. S. (*Edmonton*); W. J. (*London, N.E.*); W. T. (*London, N.*); W. K. (*No Address*); M. A. P. (*No Address*); INCUBATOR; E. A. P. (*Beckenham*); C. S. (*Leominster*); H. J. C. (*London, S.E.*); J. W. (*Wellington, Salop*); W. H. F. (*Kingston*); J. O. H. (*Wandsworth Common*); B. A. B. (*Hampstead*); G. E. L (*Battersea*); W. J. A. (*St. Helens*); DEVON; T. L. (*Peckham*); F. W. B. (*Sunderland*); W. J. D. (*Manchester*); J. E. B. (*Chesterton*); W. S. (*Pontefract*); M. P. D. (*Brighton*); W. W. (*Bristol*); F. H. (*Hull*).

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